ROSSLYN STATION NEW ENTRANCE STUDY

Final Report
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Washington Metropolitan Area Transit Authority
Department of Planning and Joint Development
Office of Business Planning and Project Development

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1.0 INTRODUCTION

The Rosslyn Metrorail station, at 1850 North Moore Street, is an important transportation center located in a high-density, mixed-use urban area of Arlington, County, serving both Orange and Blue Line trains, and eight bus lines [Figure 1].

Rosslyn Central Place (RCP)

In 2004, the JBG Companies submitted plans to redevelop the city block bounded by N. Lynn Street, 19^{th} Street, N. Moore Street, and Wilson Boulvevard with a one million square foot, mixed-use development that would span the Rosslyn station escalatorway which connects the street level mezzanine to the train platform [Figures 2 & 9]. The development was coordinated with a principal public body, the Rosslyn Working Group (RWG), that consists of local civic associations, the Rosslyn Renaissance Urban Design Committee, Arlington County staff, WMATA's Office of Adjacent Construction, and other agencies.

Study Objective

In response to the RCP development proposal, WMATA is conducting this study for Arlington County to develop and analyze conceptual designs for a new elevator entrance to the Rosslyn station and address WMATA transit operations and access needs. A new elevator entrance would improve access to the station for Metro customers and ensure a good level of service for bus and pedestrian traffic on N. Moore Street in the future.

Figure 1: Aerial Photo – Rosslyn Station Vicinity

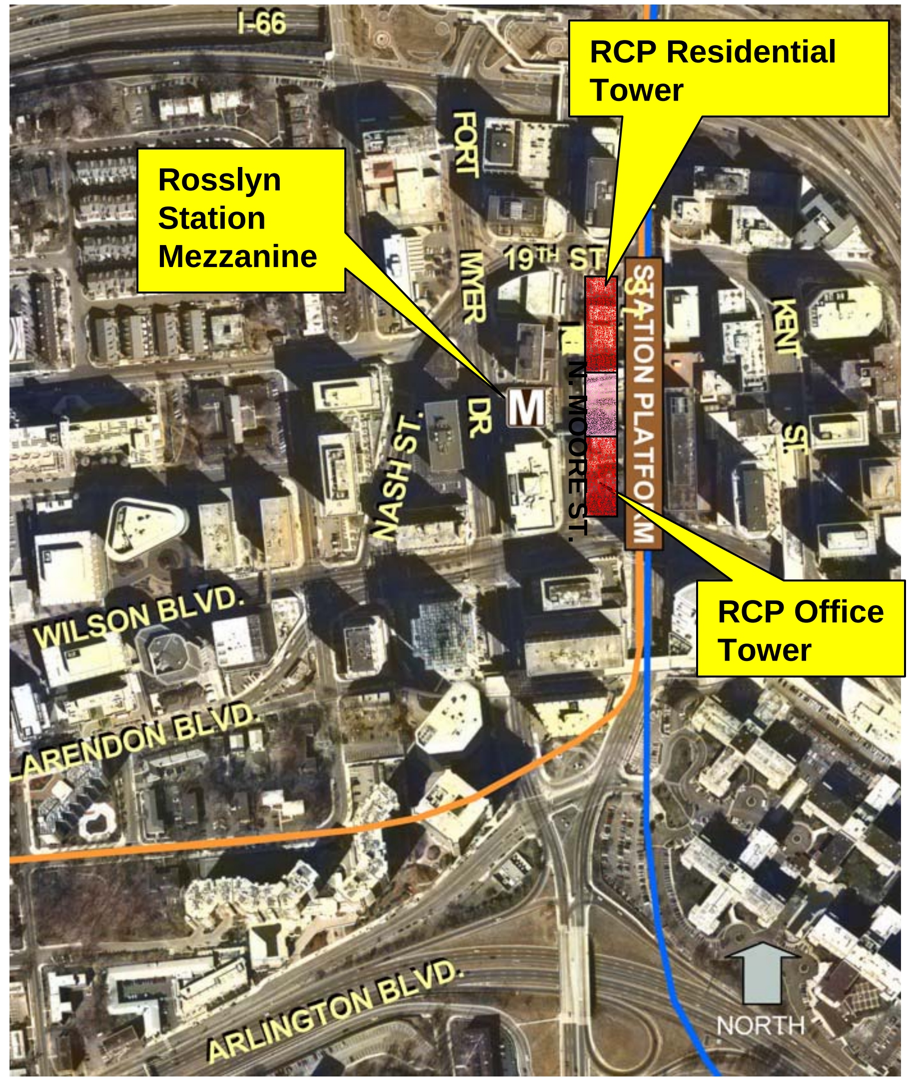


Figure 2: Rosslyn Central Place at N. Moore Street

2.0 RELATED WMATA STUDIES

2002 Rosslyn Metrorail Station Access Study

WMATA completed an earlier study for Arlington County in 2002 to identify and evaluate potential access improvements to the Rosslyn Station. The access improvements proposed in the study included improved pedestrian connections to the station, improved traffic operations on the adjacent streets, improvements for inter-modal connectivity, and also presented options for additional station entrances and mezzanines.

Two options for new station entrances were identified. The North Entrance Option included an elevator entrance at N. Lynn Street and 19th Street N. in the Waterview development that is currently under construction and includes knock-out panels in the basement structure for a future entrance. The Middle Entrance Option included a bank of three elevators from the public plaza near the existing street elevator on N. Moore Street. The proposed Rosslyn Central Place project would incorporate the new elevators into the development.

The 2002 study recommended adding at least one new entrance to the station to provide additional elevator capacity and convenient, direct access to the station platform for customers traveling from the east.

The study forecasted that Metrorail ridership at Rosslyn station would grow to 22,000 entries by 2020. With new, high-density development being proposed around the Rosslyn station or currently under construction [Table 1X], the current 2.3% annual ridership growth trend should continue, thus 22,000 daily station entries by 2020 is a realistic projection.

3.0 EXISTING CONDITIONS

The Rosslyn Station

The Rosslyn Metrorail station has a single mezzanine that can be accessed from several points: from the portal mid-block along N. Fort Meyer Drive, from the Rosslyn Center office building, from the bus bay area along North Moore Street [Figure 4], and from the skybridges, via escalators, that span N. Fort Meyer Drive and N. Moore Street [Figure 4 and Figure 5]. On the city block of the future Rosslyn Central Place project, JBG Companies is expected to acquire WMATA's fee interest for the development rights to the 3,373 sq. ft. bus alleyway, a 94 sq. ft. surface and 325 sq. ft. underground easement for the street elevator, and underground easement interests throughout the site for placement of the building foundation.

Figure 3: Rosslyn Station Area – Street Level

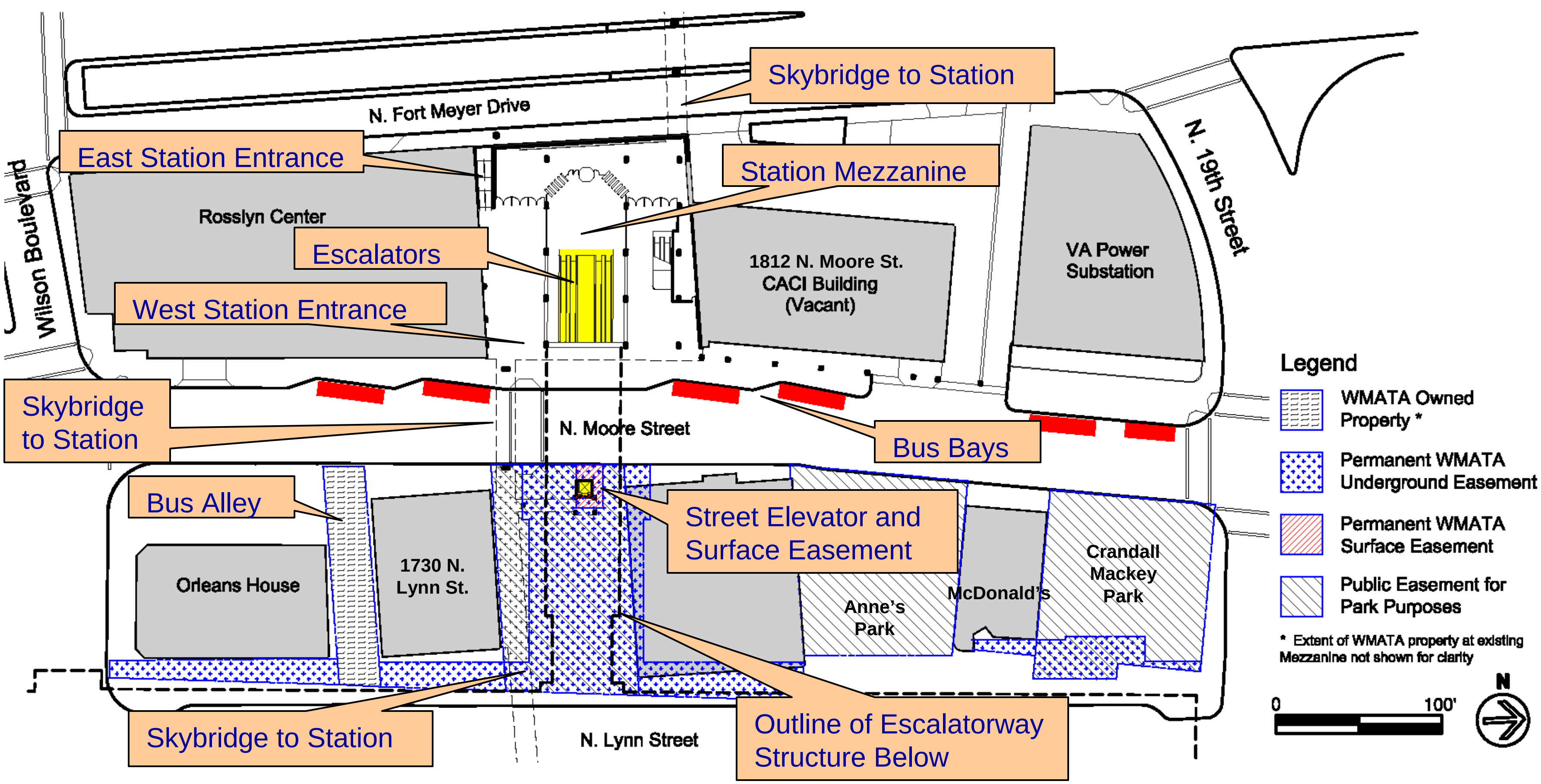


Figure 4: Rosslyn Station Entrance – N. Moore Street

Figure 5: Street Elevator in Public Park

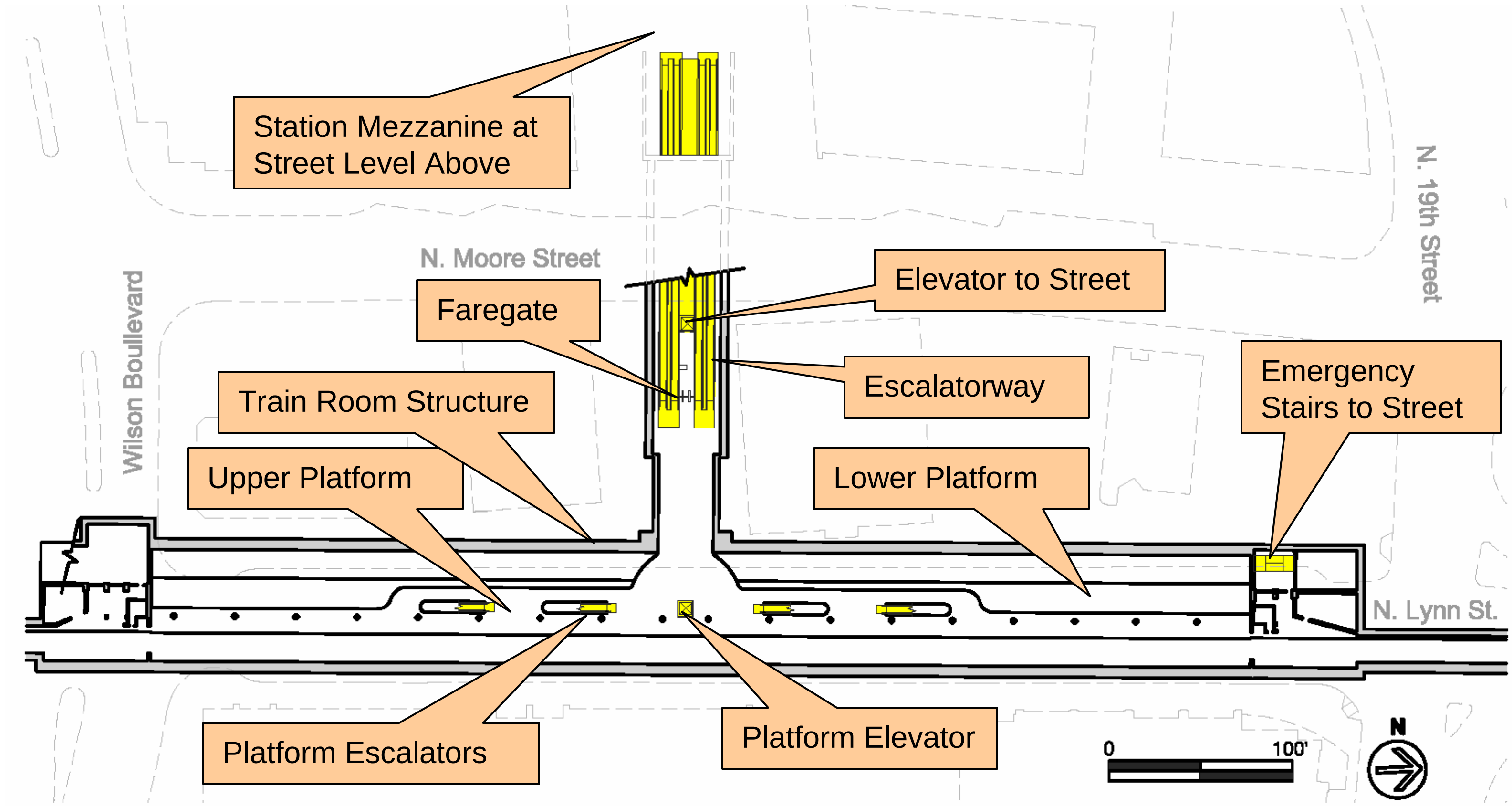
Figure 6: Bus Facilities on N. Moore Street

Figure 7: Street Elevator at Platform Level

The Rosslyn Station *(continued)*

From the street level mezzanine, customers travel 200 feet on one of the four escalators to access the upper platform level in the train room structure located below North Lynn Street [Figure 8] . Customers accessing the station via the one street elevator must use the one faregate on the platform level, between the escalators [Figure 7]. The Rosslyn Station has a split platform train room with four escalators and one elevator to the lower platform level. There is one set of emergency stairs from the upper platform level at the north end of the train room to the street level.

Figure 8:   Rosslyn Station – Upper Platform Level



Metrorail Ridership

At the Rosslyn Station, rail ridership data for 2006 indicate 16,770 boardings on an average weekday, the 9th highest number of station boardings in the the system. The number of Metrorail boardings at Rosslyn Station has increased 23% over the last ten years, up from 13,590 average weekday boardings in 1996. Of the top ten Metrorail stations in ridership, only Rosslyn and Foggy Bottom-GWU stations have a single mezzanine and entrance.

Faregate data shows that 8% of the daily station entries occur during the peak PM half hour period (5:00-5:30 PM) and 4.5% of the exits occur at that same time period. The peak half hour period is used for station planning and capacity analysis.

Table 1 shows the number of rail boardings at Rosslyn Station by the mode of access, with the percentages based on data from the 2002 Metrorail Ridership Survey. The access mode share percentages are applied to the 2006 average weekday ridership figure to estimate the current number of boardings by mode share.

Table 1: 2006 Average Daily Rail Boardings by Mode Share

Access Mode	Walk	Bus	Drop-Offs	Drove & Parked	Totals
Mode Share %	72%	17%	6%	5%	100%
Boardings by Mode	12,075	2,850	1,005	840	16,770

Station Access and Capacity

The station mezzanine has 4 escalators from the upper platform level, 12 faregates, and 11 fare vendors. Data connecting to the forthcoming 2007 WMATA Station and Access Capacity Study indicates that the escalators and faregates have ample capacity to meet existing demand and should have adequate capacity to meet ridership demand in 2020, but one additional fare vendor may be needed.

The street elevator at Rosslyn Station, located across N. Moore Street from the mezzanine, is one of the highest used elevators in the system. Data from the Metrorail Transfer Station Accessibility Program shows that Rosslyn station’s street elevator had the highest number of trips of all the elevators in the seven transfer stations with 68,150 trips during the month of August 2006. For comparisons, the street elevator at L’Enfant Plaza station was second with 29,260 trips during the same month. The 410 daily customers transferring between Metrorail and the Metrobus 5A route to Dulles Airport rely on the one street elevator to tote their luggage.

According to Arlington County estimates, there are approximately 3,500 bus boardings at the station on a typical weekday. Eight bus lines, consisting of 16 routes from four service providers access Rosslyn station: Metrobus; Arlington Transit (ART); Loudoun County Commuter Bus; and Georgetown University Transit (GUTS). During the peak hour, 44 buses access the on-street bus bays and approximately 25 private shuttles use N. Moore Street for picking-up and dropping-off transit customers. Nineteen buses use the WMATA

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alleyway to access N. Lynn Street (northbound) in the peak hour to avoid traffic backups at the Wilson Boulevard intersections at N. Moore Street and N. Lynn Street.

On the east side of N. Moore Street there is a curbside lane for taxis, a bus stop for the ART 61B route, an accessible pick-up/drop-off lane in front of the station street elevator, and street parking.

There can be times during the evening peak period when the combined activities of buses, pedestrians, taxis, and automobiles contribute to constrained operating conditions throughout the length of N. Moore street between Wilson Boulevard and 19th Street [Figure 6].

Station Access Deficiencies

Like most Metrorail stations, Rosslyn station is inaccessible to customers using wheelchairs when either the single street elevator or the platform elevator is out of service. When either elevator is out of service for extended rehabilitation, customers using wheelchairs must use the elevators at the nearest station, then transfer to the destination station using Metrobus shuttle service.

For short-term elevator service disruptions, a bus must be dispatched on demand. During elevator outages, customers using strollers, wheeled luggage, and seniors with balance problems are forced to request a bus shuttle or use the escalators. WMATA policy prohibits strollers and wheeled luggage on escalators for safety reasons.

Customers using the street elevator currently experience frequent problems with the single faregate when farecards become jammed, requiring assistance from the station manager [Figure 7].

4.0 NEW ELEVATOR ENTRANCE AND MEZZANINE

Design Goals

The primary objective of the study is to develop conceptual design alternatives and analysis to justify the need for a new elevator entrance that would be incorporated into the proposed Rosslyn Central Place development and be easily accessed by Metrorail customers. A major goal in the design of the new elevator entrance is to minimize impacts to the development and construction scheduling. The development should also be planned to minimize impacts to existing WMATA facilities and operations as is discussed later Sections. Indeed, the foundation system for an earlier RCP concept design with the office tower located directly above the existing station escalatorway proved too costly and the project was redesigned to relocate the public plaza to the center of the site, greatly reducing the design loads above the escalatorway and future underground mezzanine structure.

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Due to the complexity of excavating and constructing a new underground transit facility with an elevator hoistway adjacent to an existing Metrorail station and below a mixed-use development, the concept design required extensive coordination in numerous project meetings with the project study team. Members of the study team included Arlington County staff, the JBG Companies, JBG's consultants, and WMATA architects, engineers, and planners.

Demand Analysis

Planning for a new elevator entrance began with projections for future entries and exits, and an assessment of capacity requirements for the new mezzanine and the vertical transportation systems.

In determining entry and exit projections, the study assumed that all people accessing the station from east of N. Moore Street would use the new elevators in lieu of the existing escalators to reduce their travel time to the station platform by up to 2.25 minutes. Figure 1X in the Appendix shows the station area used in calculating projected transit trips to the new entrance.

Using Arlington County development forecasts, an analysis of trip generation data estimates that in the full development build-out year (2015), approximately 4,402 customers would enter the new elevator entrance in the PM peak period with 1,566 entries in the AM peak period [Table 1X]. The only new planned development in the area for trip generation calculations are two JBG Company developments: Waterview, currently under construction; and RCP. The combined transit trips from the JBG developments to the new station entrance will account for 28% of the total entries (1,252 PM/418 AM peak entries).

In station capacity planning, WMATA uses peak half-hour demand projections to ensure that the new station mezzanine and elevators can comfortably, safely, and efficiently accommodate Metrorail customers. Existing faregate data indicates that 18% of the station entries in the peak PM (4 hour) period occur during the peak half-hour period and 17% of the exits at that same time [Table 2X and 3X]. Assuming the same trend in 2015, passenger volumes at the new entrance during the PM peak half-hour would be 810 entries/261 exits [Table 1X] and 331 entries/804 exits in the AM peak half-hour period [Table 3X]. See Appendix 1.0 for a detailed description of the methodology for calculating projected entry/exits to the new elevator entrance.

Elevator Capacity

To determine the optimum number of elevators required to handle the projected passenger volumes in the peak half-hour periods, an elevator capacity analysis was performed using estimated time of arrival volumes for customers accessing the station via the elevators [Table 2].

The analysis indicates that three high-speed, high capacity elevators (350 fpm/4500 lb) can handle the

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projected passenger volumes. The analysis assumes that the existing street elevator will be removed from service when the three new elevators are in operation.

In Scenario 1, Table 2 shows that a bank of three elevators with a travel distance of approximately 95 feet and an average of 15 passengers per car, has the capacity to handle 898 passenger entries in a 30 minute period, which is greater than the 810 entries projected in 2015 during the PM peak half-hour period. Scenario 2 shows that two elevators with 20 passengers per car could handle 680 entries in a 30-minute period but with crowded conditions and 84% of the capacity required to handle the projected peak volume of 810 entries. During periods when the demand for elevators may exceed capacity, able-bodied passengers could use the existing escalators. The escalator mezzanine would continue to be the main entrance to the station.

Table 2 also calculates the maximum queuing volumes of passengers waiting for an elevator. The queuing volumes for passengers on the street level are determined by the estimated

Table 2: Elevator Capacity and Queuing Analysis

	Scenario 1			Scenario 2		
Passengerss Per Elevator Car (entering station)	**15**			**20**		
Passengers Per Elevator Car (exiting station)	**7.5**			**10**		
Passenger unloading top(sec)	7.88			10.50		
Passenger loading top(sec)	15.75			21.00		
Doors closing (sec)	2.50			2.50		
Travel time (sec)	16.46			16.46		
Levelling time (sec)	1.00			1.00		
Doors opening (sec)	1.50			1.50		
Passenger unloading bottom(sec)	15.75			21.00		
Passenger loading bottom(sec)	7.88			10.50		
Doors closing (sec)	2.50			2.50		
Travel time (sec)	16.46			16.46		
Levelling time (sec)	1.00			1.00		
Doors opening (sec)	1.50			1.50		
Round trip time =	90.17			105.92		
Number of Elevators	**1**	**2**	**3**	**1**	**2**	**3**
Entering						
Passenger capacity per 30 minutes (entering)	299	599	**898**	340	**680**	1,020
Exiting						
Passenger capacity per 30 minutes (exiting)	150	299	449	170	340	510
Interval Between Elevators	**90.17**	**45.09**	**30.06**	**105.92**	**52.96**	**35.31**
Maximum Queueing - Street - 2020						
Entries (sec)	0.42	0.42	0.42	0.42	0.42	0.42
Interval between elevators (sec)	90.17	45.09	30.06	105.92	52.96	35.31
Passengers per elevator cycle	38	19	13	44	22	15
Passengers loaded per elevator cycle	15	15	15	20	20	20
Remaining Queue	23	4	0	24	2	0
Maximum Queue	60	23	13	68	24	15
Maximum Queueing - Mezzanine - 2020						
Exits (per train)	57.23	57.23	57.23	57.23	57.23	57.23
Interval between elevators (sec)	90.17	45.09	30.06	105.92	52.96	35.31
Interval between trains	138	138	138	138	138	138
Elevator cycle per train	1.54	3.07	4.61	1.31	2.61	3.92
Passengers loaded per elevator cycle	15	15	15	20	20	20
Initial Queue	57	57	57	57	57	57
Remaining Queue	34	11	0	31	5	0
Maximum Queue	91	68	57	88	62	57

rate of arrival and the number of elevator trips. The methodology for estimating queuing volumes for passengers waiting for an elevator on the platform is based on the number of passengers exiting two alighted trains on the station platforms. See Appendix 2.0 for the methodology used in calculating the elevator queuing capacity.

Design Concepts – Alternative 1

Important design precepts that were established by the study team for developing a conceptual design is to: optimize the layout of the mezzanine for efficiency in regards to the potential high cost of building an underground structure where rock excavation is required; minimize impacts from the elevator and stair shaft to the parking garage and public plaza above; avoid impacting existing underground station structures; and minimize impacts to the development construction scheduling and sequencing.

At the time of this study, JBG Companies intends to build the RCP project in two phases with the office tower first, then the residential tower at a latter time [Figure 9]. The new elevator entrance structure must be located within the building footprint of the Phase I office tower.

The concept designs presented in this study as Alternative 1and Alternative 2 were developed to meet: established planning goals; WMATA's design standards and criteria for station facilities; the capacity demand analysis; and the desires of Arlington County and JBG Companies to the maximum extent possible.

The Alternative 1 concept plan is shown in Figures 10 through 13 with the following program description:

<u>Concourse Plan</u> [Figure 10]: The new mezzanine would be connected to the existing passageway by cutting through the wall of the station passageway structure. Fire doors located in the passageway to air-pressurized concourse mezzanine would automatically close in the event of an emergency, creating an area of safety in the mezzanine.

WMATA structural design criteria required a minimum 30 foot setback from the existing train room structure and a minimum 15 foot setback from the existing escalatorway structure to the new concourse structure to avoid the rock bolts used in the construction of the original station.

The north wall of the concourse structure aligns with the residential building facade above, which is the separation line between the Phase I and II buildings [Figure 9]. The elevators are located to coordinate with the garage parking aisle and structure above.

To limit the floor area of the concourse structure, only the public toilet, staff toilet, and cleaner's room are located on the same level with the manager's kiosk. An exit stair from the mezzanine to the street level is provided to meet local building codes for emergency egress requirements. The width of the stair and egress path shall be sized in accordance to capacity requirements (to be determined).

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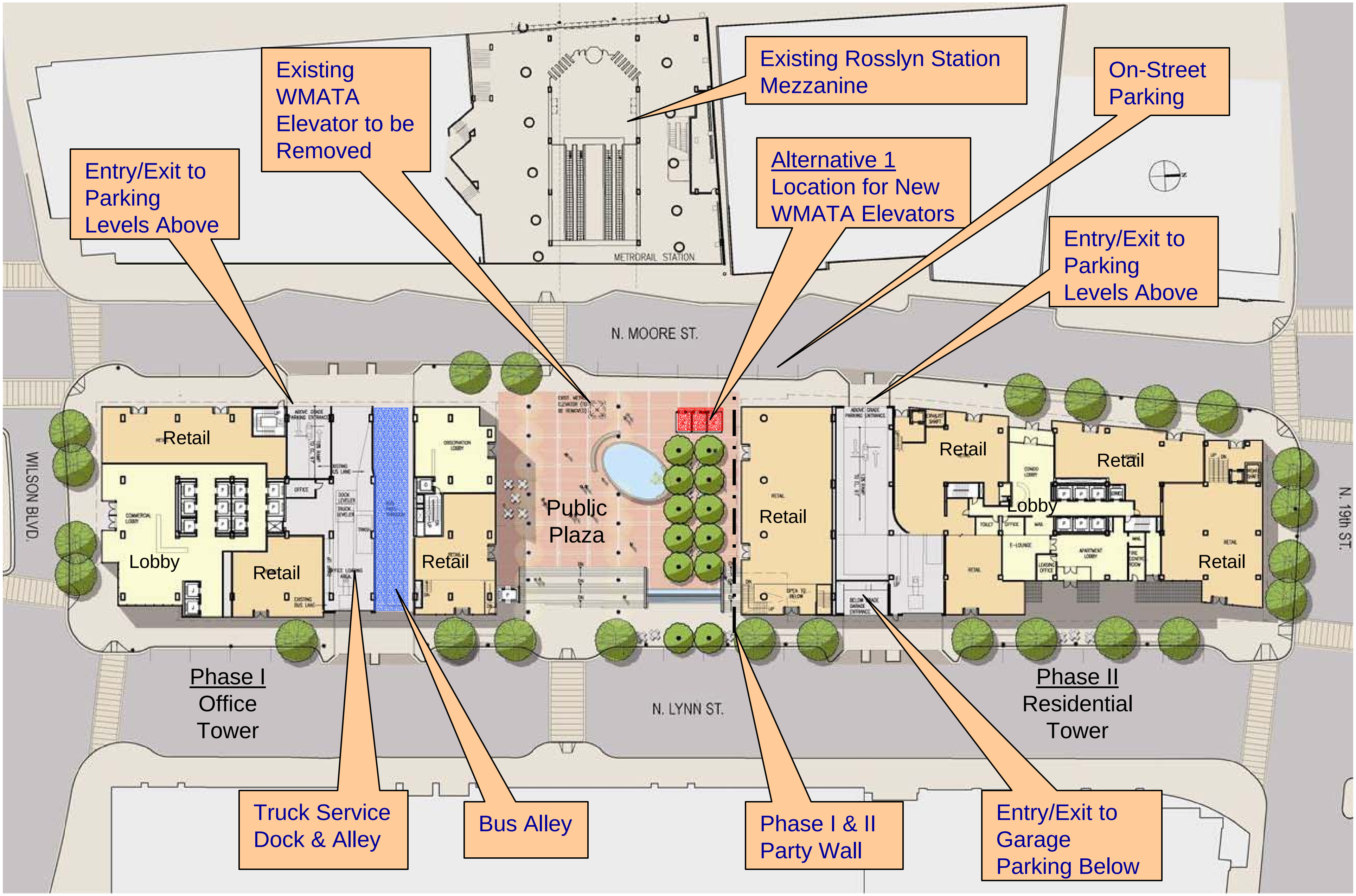
Figure 9: Rosslyn Central Place – Ground Level Plan



The WMATA study team considered excluding the station manager's kiosk from the program to reduce the floor area of the mezzanine, thus reducing the required area of excavation and construction costs. However, it was later determined that the enhanced communications system required for remote monitoring from the existing manager's kiosk would exceed the cost of adding a kiosk to the new mezzanine. In addition, WMATA staff presence at the faregates is desired to serve customers who may need assistance. With remote monitoring, if a customer called the kiosk for assistance, it would take between 1 1/2 to 3 minutes for the station manager to travel to the location of the proposed mezzanine faregates.

The fare collection system consists of four faregates and five fare vendors. Table 6X in the Appendix indicates that 6 fare vendors are needed to handle transactions the peak 30 minute period, however, with wall space limited and adequate elevator queuing space needed, only 5 fare vendors can be accommodated which will be adequate, but not optimum.

The existing street elevator and fare collection system would be removed after the new elevators are in service. Eliminating the existing elevator would recapture parking spaces on the two parking garage levels above and would eliminate the frequent problems customers experience with the fare transactions at the existing remote, mini-mezzanine.

<u>N. Lynn Street Level Plan</u> [Figure 11]: Service rooms that support the concourse below are located in unused space above the parking ramp to lower parking levels and would be accessible from the sidewalk by WMATA staff.

The final locations of the service rooms will need to be coordinated with JBG as the building plans develop, however, the minimum program requirements shall be consistent: Mechanical Room (225 s.f.) with equipment and fresh air intake sized to provide conditioned and pressurized air to the mezzanine concourse as necessary; Electrical Room (25 s.f.); Telephone /Communications Room (15 s.f.); and Fire Equipment Closet (20 s.f.).

The outside wall of the elevator hoistway is located along the edge of the parking drive aisle. The bank of three elevators would ultimately displace three parking spaces on each garage level, but one space on each level would be gained when the existing elevator is removed. The exit stairway structure transitions to outside the building for access from the sidewalk along N. Moore Street.

<u>N. Moore Street Level Plan</u> [Figure 12]: The location of the elevators in the public plaza is set back from the building line to allow additional queue space on the sidewalk in front of the curb on N. Moore Street [Figure 3X]. The elevator head house and the elevator cars should be glazed on all sides for visiblity and security. The elevator location displaces a 325 sq. ft. area at the public plaza, but does not displace retail space.

<u>Longitudinal Section</u> [Figure 13]: The excavation for the concourse structure shows a rock support system similar to the construction of the existing train room and escalatorway structure; however, the preferred method for shoring, excavating, tunneling, and concrete work would be determined by actual soil conditions and costs.

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Figure 10: Alternative 1 - Concourse Plan – Upper Platform Level

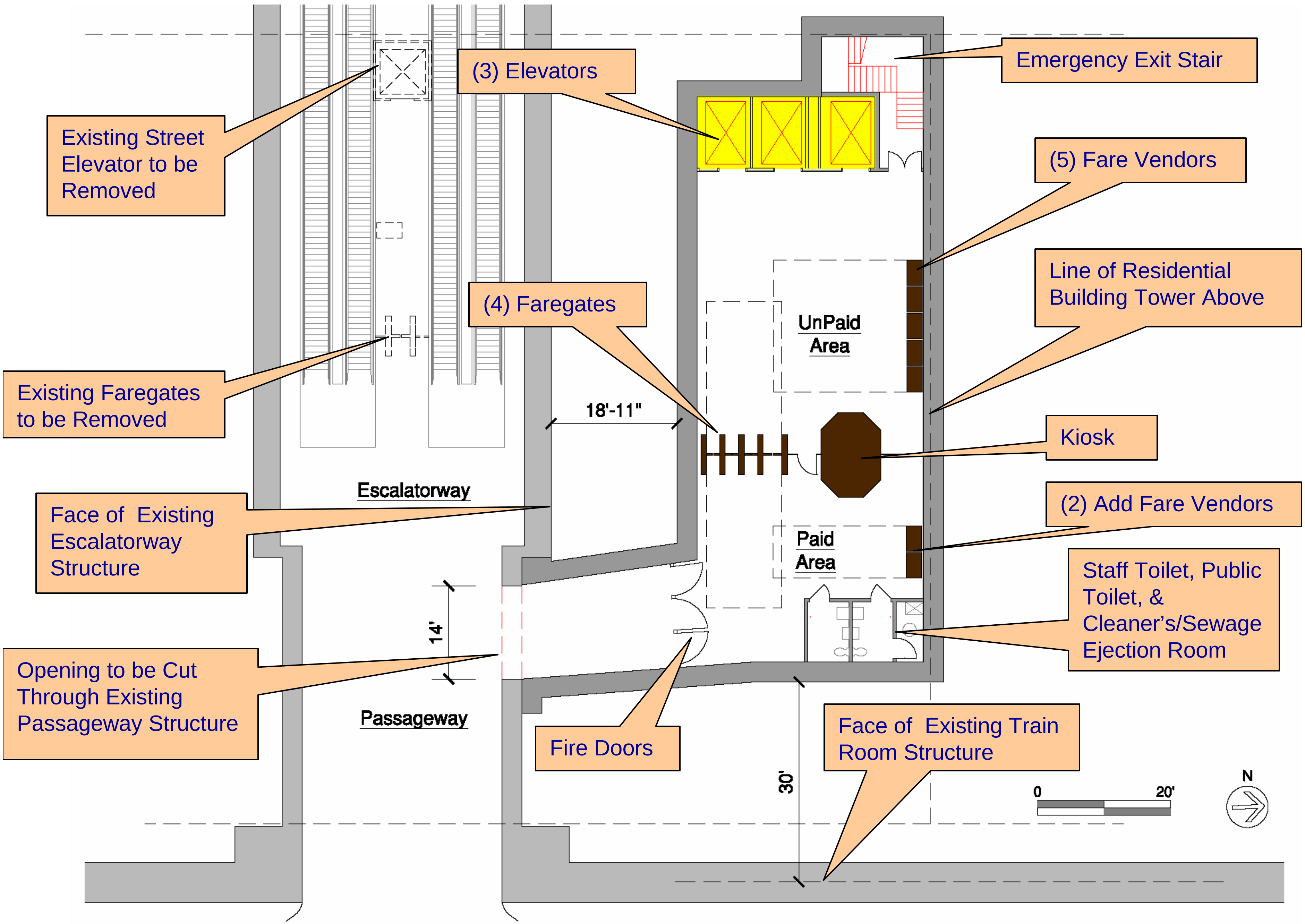


Figure 11: Alternative 1 - N. Lynn Street Level Plan

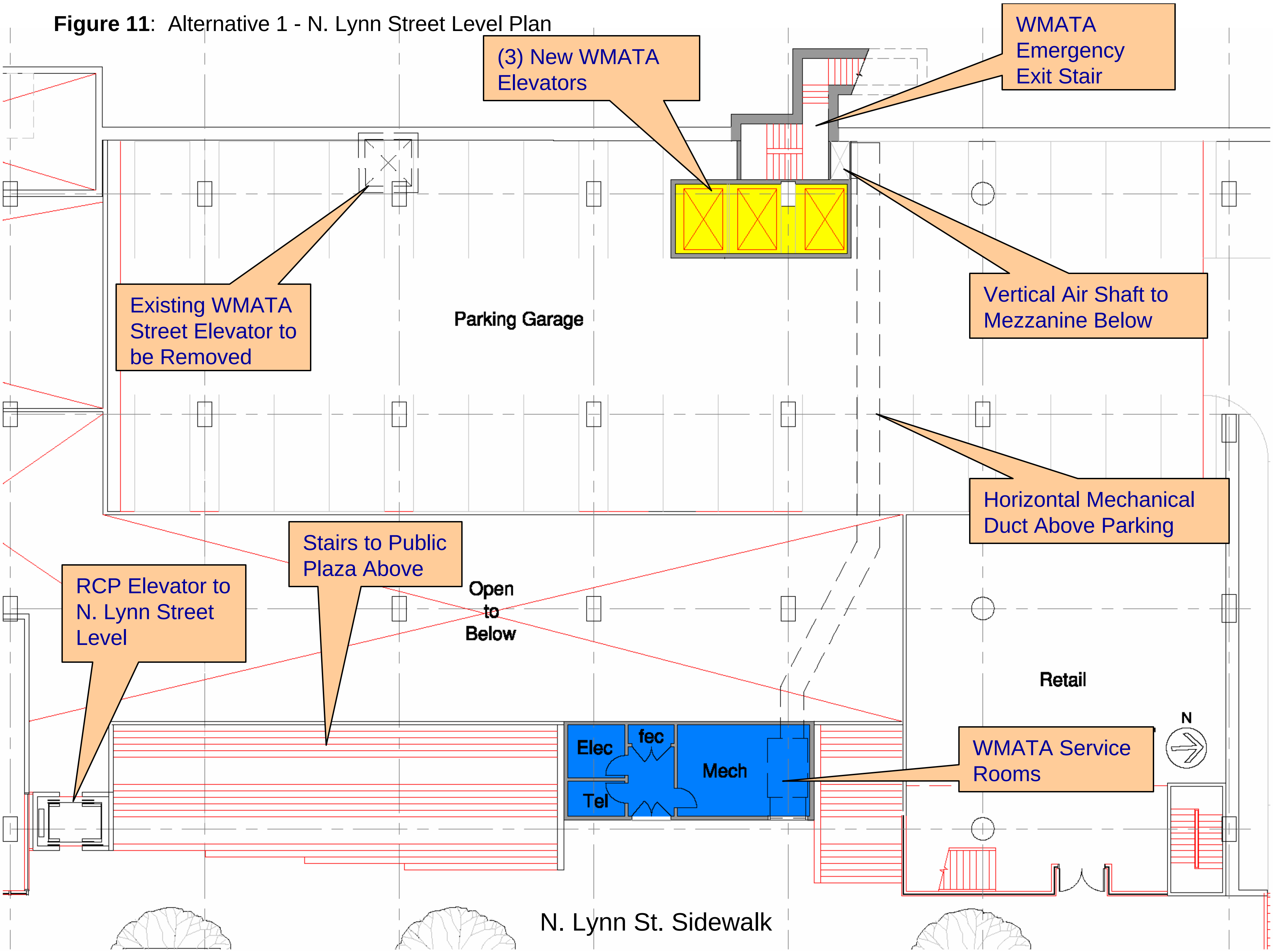
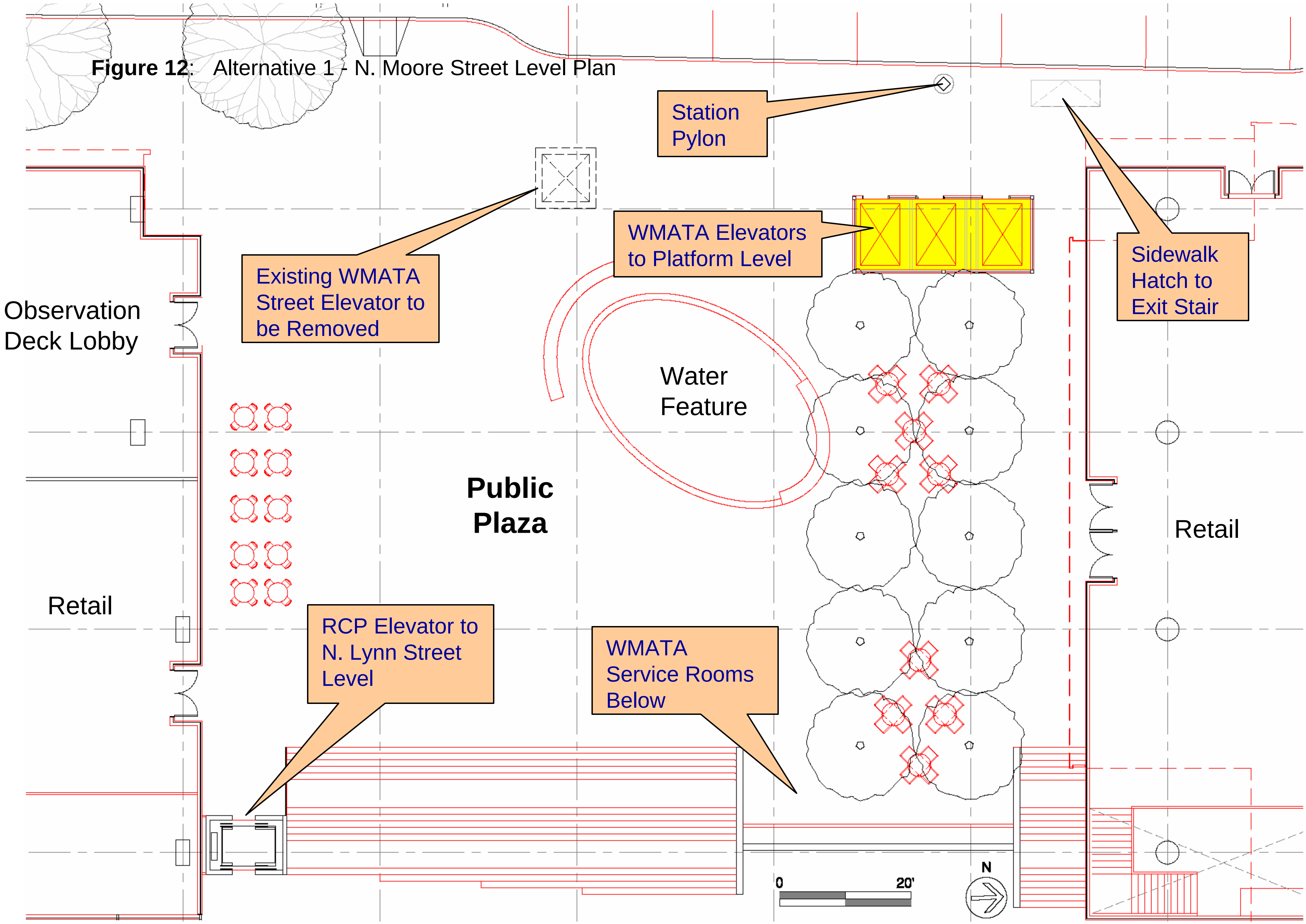


Figure 12: Alternative 1 - N. Moore Street Level Plan



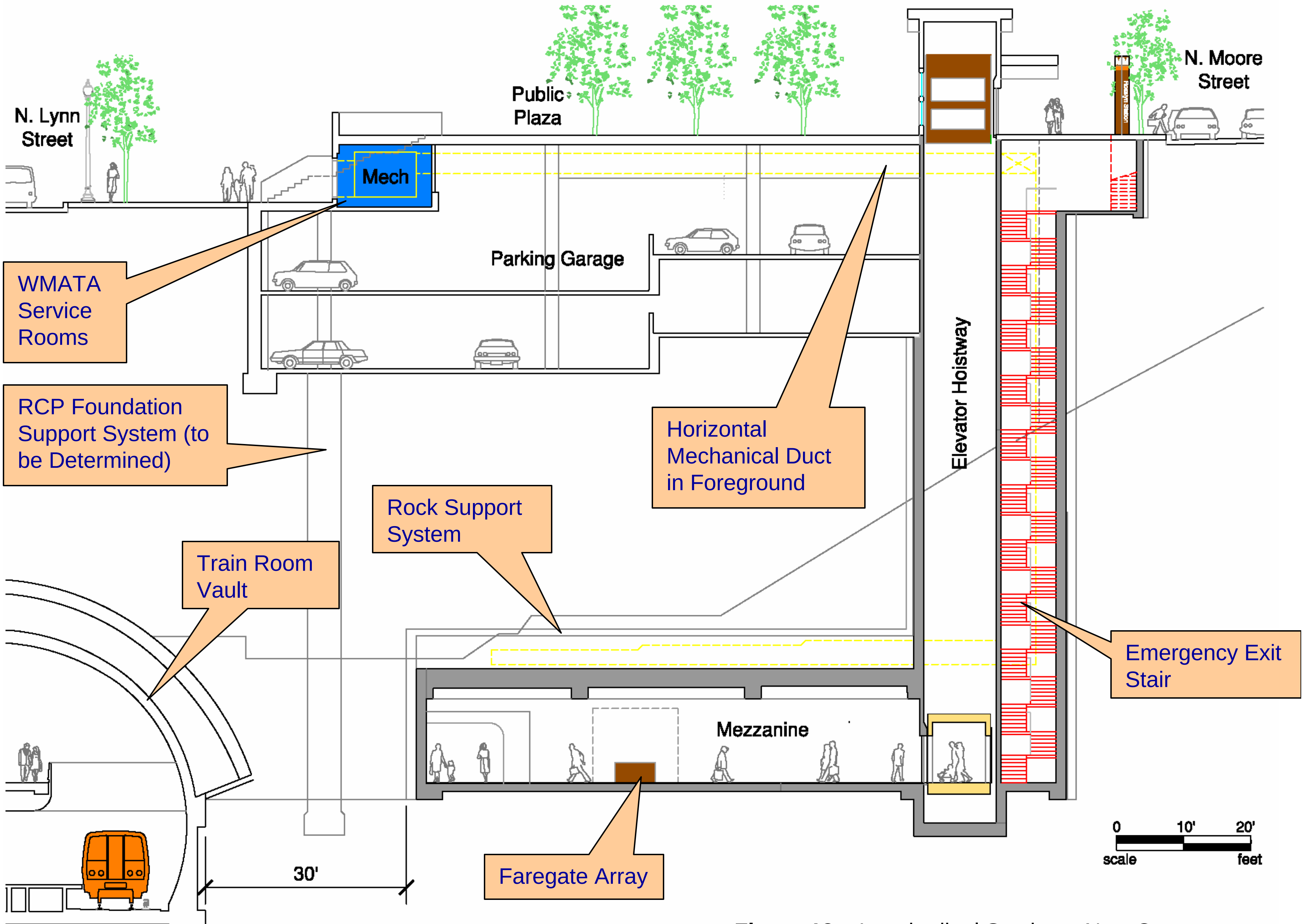


Figure 13: Longitudinal Section – New Concourse

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The drawing shows a gearless elevator system with the machine, governor, and support elements combined into a compact integrated machine structured housed at the top of the hoistway, eliminating the need for a machine room, reducing visual impacts from the public plaza.

The Order of Magnitude Cost Estimate for Alternative 1 is shown in Table 3. Given the high cost of excavating and building an underground mezzanine structure in solid rock, another Alternative was considered that reduces the extent of underground excavation.

Design Concepts – Alternative 2

The concept design for Alternative 2 locates the mezzanine facilities on the public plaza at ground level to minimize the extent of rock excavation [Figures 14 through 16].

Concourse Level Plan [Figure 14]: The station mezzanine facility is located on the street level reducing the area of rock excavation for the concourse to approximately 4,935 cubic yards, which is 4,180 less cublic yards than Alternative 1. A new tunnel connects the existing passageway to the an elevator vestibule with three elevators and an emergency exit stair shaft leading to the sidewalk on N. Lynn Street. The Vestibule is air-pressurized with the fire doors.

N. Lynn Street Level Plan [Figure 15]: A hoistway for three elevator would displace four parking spaces on each garage level. The egress stair shaft transfers below the slab of the B2 garage level to the outside of the building foundation and exits on the sidewalk at N. Lynn Street. Similar to the Alternative 1 plan, WMATA service rooms that support the concourse below may be located in the unused space above the parking ramp to lower parking levels with access from the adjacent sidewalk. A staff toilet for the station manager would be included in the Service Room program.

N. Moore Street Level Plan [Figure 16]: At street level, the new station mezzanine pavilion is accessed directly from the public plaza between the office and residential towers. The mezzanine pavilion would be constructed of glazed walls, designed to match the exterior finish systems of the Rosslyn Central Place development. With less rock excavation required, locating the mezzanine on the street level would be less costly to build than Alternative 1, but would displace approximately 2,440 square feet (19%) of the public plaza.

The Rosslyn Central Place development will displace approximately 28,000 sq. ft. of public park easements [Figure 3]. The 12,725 sq. ft. public plaza is being provided by the developer as one of the community benefits requested by the Rosslyn Working Group, so opposition to the mezzanine pavilion could be expected. The street elevators in Alternative 1 would have minimal impact to the public plaza.

Surrounded by 47,000 sq. ft. of retail and directly connected to the publicly-accessible observation deck on the office tower's 20th floor via an express elevator, the public plaza should become the main activity center of Rosslyn. With conference facilities, a café, an outdoor terrace, and panoramic views of Washington's
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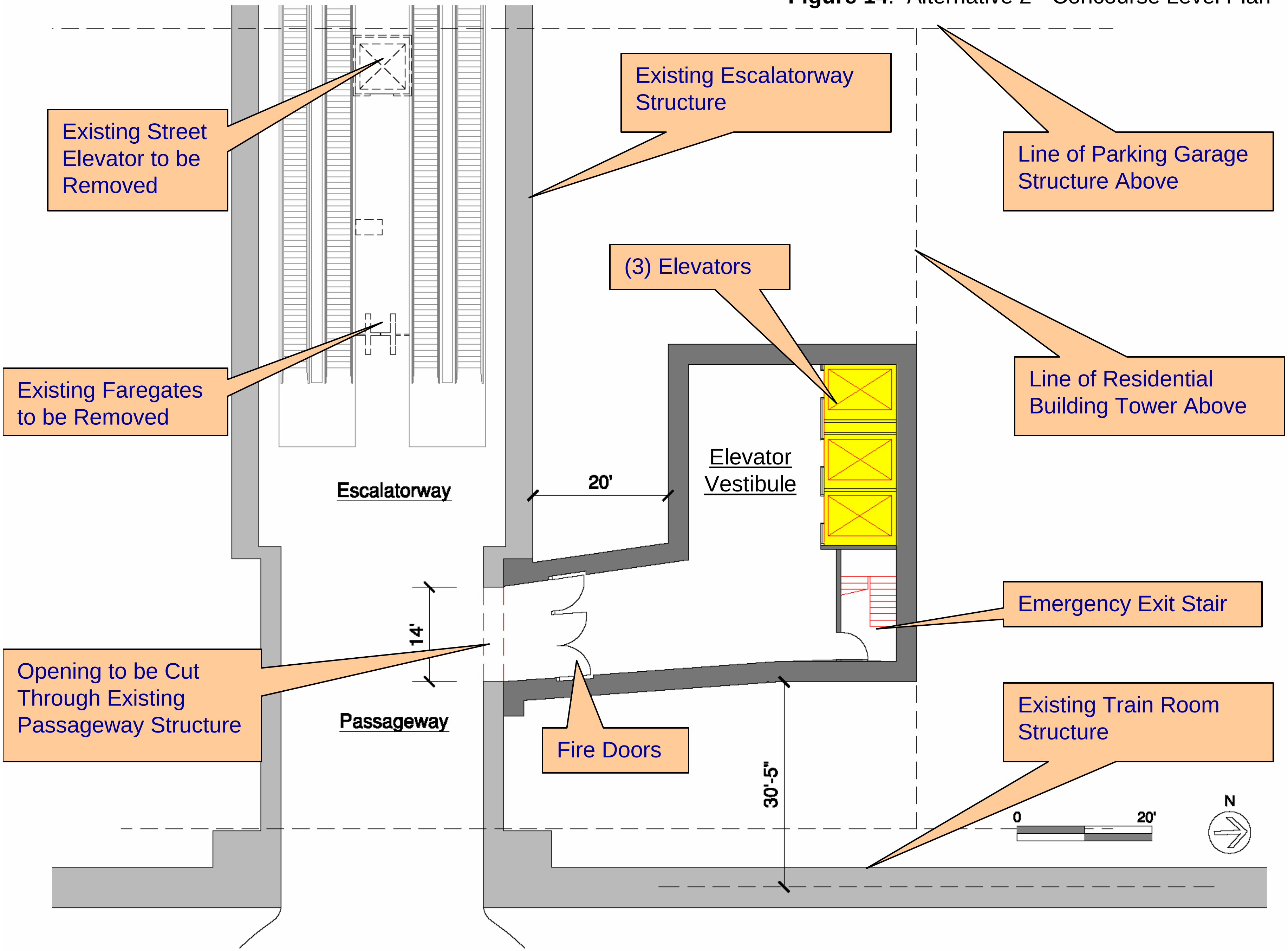
Figure 14: Alternative 2 - Concourse Level Plan



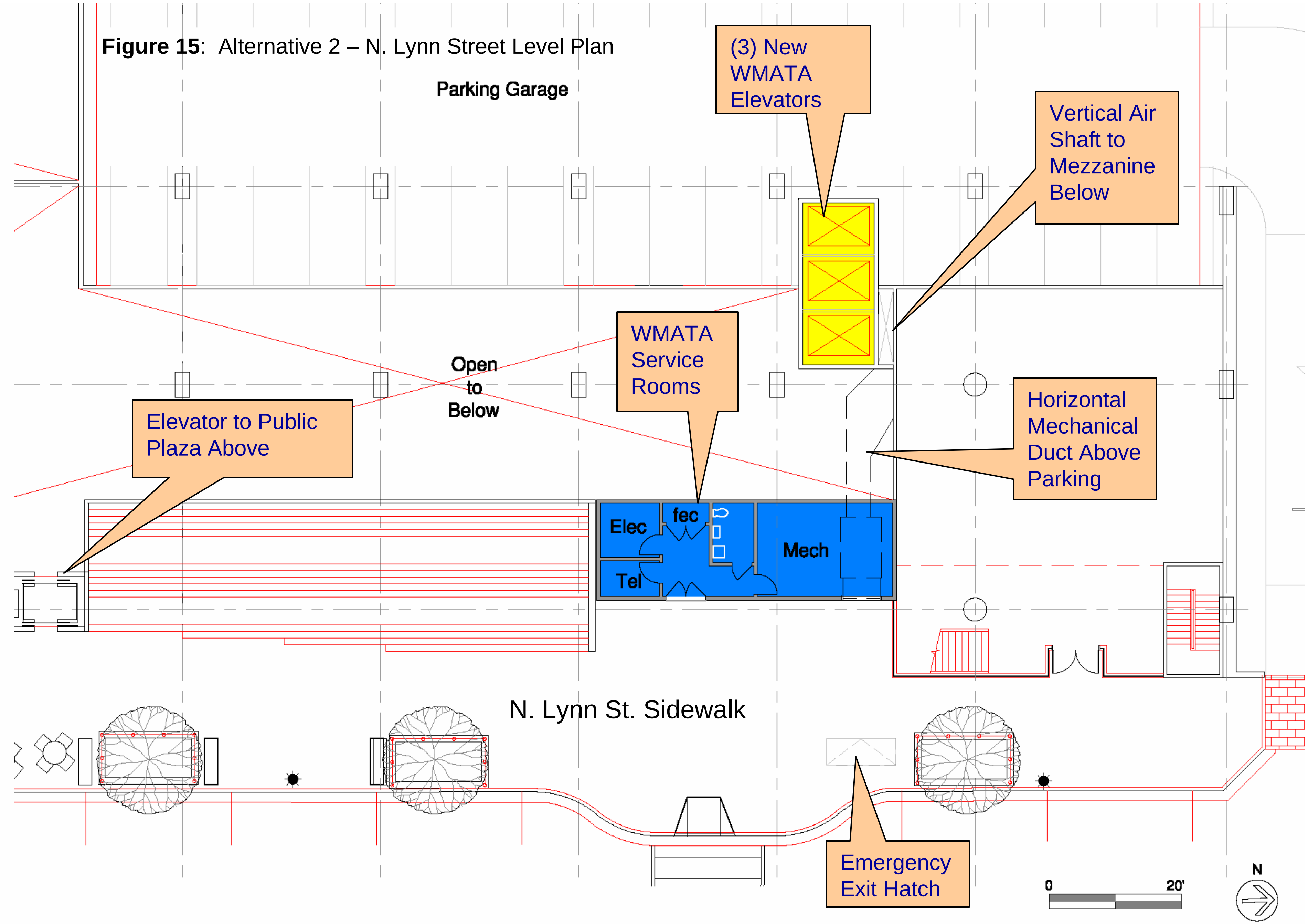
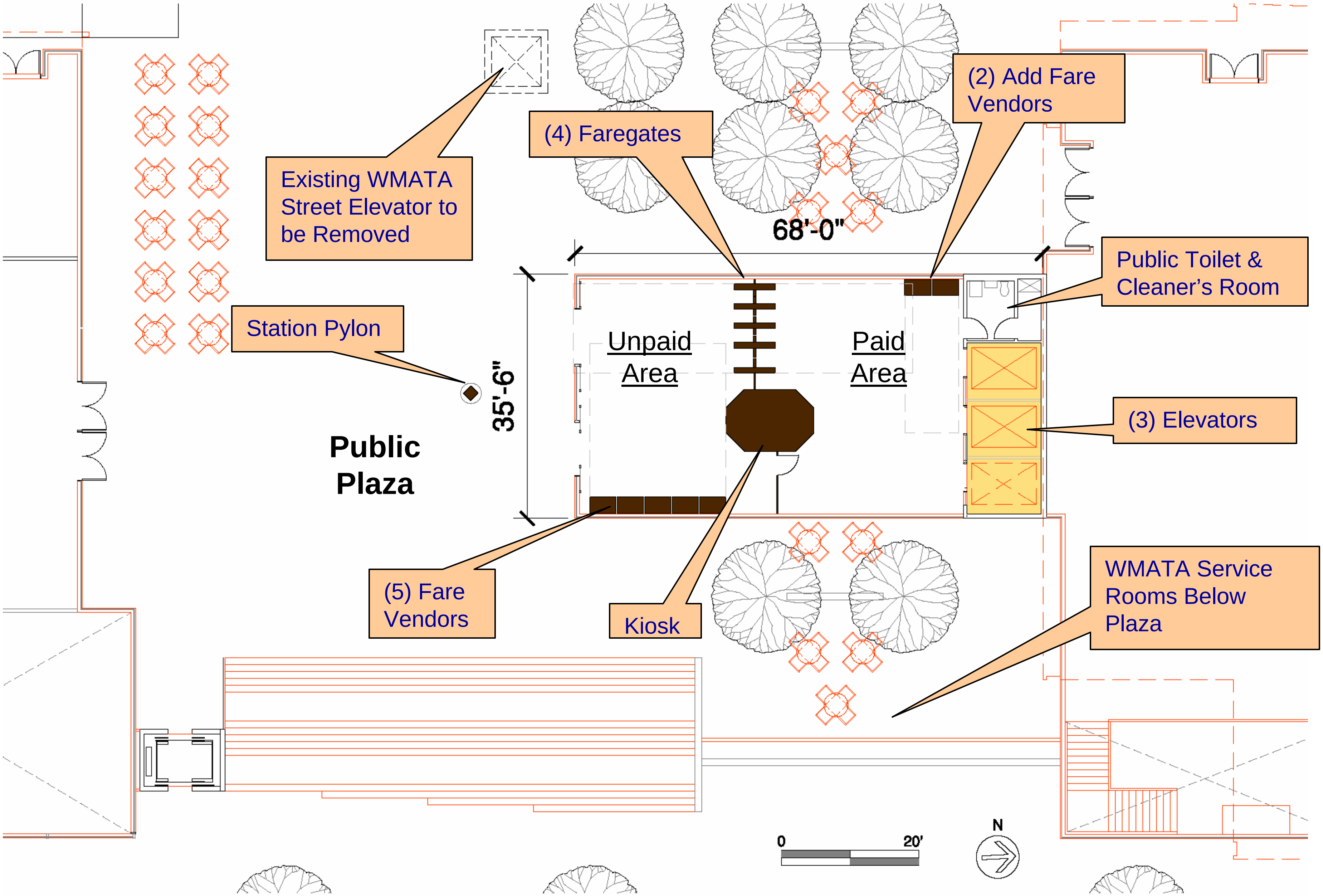


Figure 15: Alternative 2 – N. Lynn Street Level Plan
Parking Garage
(3) New WMATA Elevators
Vertical Air Shaft to Mezzanine Below
Open to Below
WMATA Service Rooms
Elevator to Public Plaza Above
Horizontal Mechanical Duct Above Parking
Elec
fec
Tel
Mech
N. Lynn St. Sidewalk
Emergency Exit Hatch
0
20'
N

Figure 16: Alternative 2 – N. Moore Street Level Plan



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monumental core, JBG Companies expects the two-level observation deck to draw up to 450,000 visitors annually. The new station elevators at the public plaza would support the developer's goal of making the RCP development a new Rosslyn destination.

Order of Magnitude

Tables 3 and 4 show the order of magnitude cost estimates respectively, for both Alternative 1 and Alternative 2. For both Tables, the construction costs included in Item 10 are: materials, labor, contractor's overhead and profit in addition to a 10-15% design contingency. The Soft Costs shown in Item 12 are 35% of the estimated construction cost for design and construction management.

In Alternative 2, much of the cost savings from not having to excavate through rock for a underground mezzanine, is offset by the cost of the mezzanine pavilion. For the total construction cost, the difference between Alternative 1 and Alternative 2 is only $3,062,100. The cost delta between the two Alternates for rock excavation and hauling is $5,243,825. The cost of the mezzanine pavilion in Alternative 2 is $2,259,170.

The cost savings in the development's foundation structure from not having to span over a larger underground mezzanine structure is not considered since the design and costs are unknown at this time.

5.0 TRAFFIC AND DEVELOPMENT IMPACTS

The Rosslyn Central Place development is expected to impact pedestrian and automobile traffic on N. Moore Street where the station bus facilities are located. It is in WMATA's interest to preserve the functionality of the Rosslyn station serving bus as well as rail customers.

WMATA is committed to preserving the facilities that support reliable bus operation and movement. To this end, WMATA provided Arlington County with two key requirements and one critical need in regards to the RCP project: requirements for the bus alley location; requirements for the transit facilities located on N. Moore Street; and the need for the new elevator entrance.

Bus Alley Requirements

The WMATA bus alleyway from N. Moore Street to N. Lynn Street is located near the existing location adjacent to the office buildings pull-through service dock. WMATA had requested that the bus alleyway entrance be located 150 to 200 feet from the Wilson Boulevard intersection and north of the truck dock and parking entrances to minimize traffic conflicts between the buses, trucks, and automobiles. JBG ultimately located the bus alleyway 180 feet from Wilson Boulevard which allows. enough queuing distance in front of the Wilson Boulevard intersection for buses to make the turn into the alleyway entrance without waiting for the traffic to clear.

The entrance must have a 22 foot minimum width to accommodate a wide bus turning radius and a minimum

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Table 3: Alternative 1 – Order of Magnitude

Item No.	Element	Approx. Cost (FY06 $)
1	Demolition and Site Preparation	$1,300,820
2	Elevator/Stair Shaft Excavation & Structure	$6,785,060
3	Mezzanine Excavation & Structure	$7,136,000
4	Passageway Excavation & Structure	$1,123,950
5	Escalatorway/Passageway Connection	$437,260
6	Interior Architectural Construction	$553,580
7	Station Equipment & Finishes	$1,913,090
8	Vertical Transportation Systems	$3,996,900
9	Mechanical, Plumbing, & Electrical	$2,027,180
10	**Construction Contract Cost**	**$25,303,840**
11	Soft Costs: Design+Engineering (10%), Design Management (10%), Construction Support (10%), Insurance/Bond (5%)	$8,856,340
12	**Total Project Cost**	**$**34,160,180

Estimate in FY06 dollars with 10%-15% design contingency and priced as stand alone construction contract.

Table 4: Alternative 2 – Order of Magnitude

Item No.	Element	Approx. Cost (FY06 $)
1	Demolition and Site Preparation	$1,300,820
2	Elevator/Stair Shaft Excavation & Structure	$6,776,780
3	Mezzanine Excavation & Structure	$2,597,780
4	Passageway Excavation & Structure	$1,124,660
5	Escalatorway/Passageway Connection	$437,260
6	Interior Architectural Construction	$654,780
7	Station Equipment & Finishes	$1,946,620
8	Vertical Transportation Systems	$3,996,900
9	Mechanical, Plumbing, & Electrical	$1,146,970
10	**Mezzanine Pavillion**	**$2,259,170**
11	**Construction Contract Cost**	**$22,241,740**
12	Soft Costs: Design+Engineering (10%), Design Management (10%), Construction Support (10%), Insurance/Bond (5%)	$7,784,610
13	**Total Project Cost**	**$30,026,350**

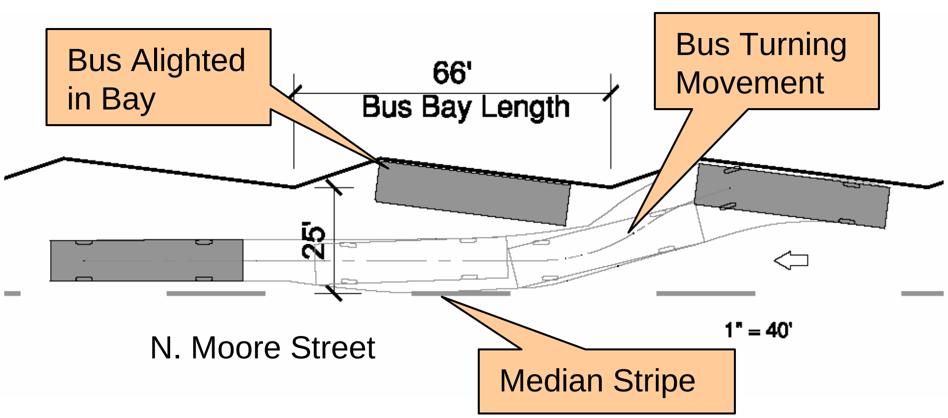
(continued)

14’-6” vertical height clearance for entire length of the alleyway. JBG was advised to coordinate requirements for bus facilities systems under structure with the Arlington County Fire Marshall in regards to compressed natural gas powered (CNG) buses.

Transit Facility Requirements on N. Moore Street

The RCP plan proposes to reduce the overall width of North Moore Street by approximately 3 feet, 6 inches to accommodate a wider building footprint which in turn, reduces the width of the southbound lanes from 25 feet to 21 feet, 6 inches. A 25 foot width, measured from the outside corner of the sawtooth bus bays to center median stripe, must be maintained to allow buses adequate clearance to pull around another bus parked in a bay without encroaching on the northbound travel lane [Figure 17].

Figure 17: Bus Turning Movements



The RCP plan also proposes to eliminate most of the curbside parking spaces along the northbound lane to provide a wider sidewalk. To maintain traffic flow in the northbound lane, the street plan should include adequate curbside space for taxis, automobile pick-up/drop-off activity, private shuttle buses, and the ART 61 bus stop.

Traffic Impacts from Development

According to the 2005 RCP Traffic Analysis and Transportation Management Plan by Well & Associates, the RCP development will ultimately generate approximately 362 net-new AM peak hour vehicle trips and 378 net-new PM peak hour trips. In the peak PM hour, 83 automobiles are expected to enter and 160 automobiles are expected to exit the RCP development at the two access points onto N. Moore Street from the 445 spaces in each of the above-grade parking levels[Figure 9]. Currently, there is only one garage exit on the southbound lane from 129 spaces for the office building at 1730 N. Moore Street. The entry/exit for the 395 spaces in the RCP below grade parking is located on N. Lynn Street.

The proposed 30 story office tower at 1812 N. Moore Street which is currently under review by the County is located adjacent to the station mezzanine and would replace the vacant 97,000 sq. ft. CACI building. The development proposes 541 parking spaces with 122 garage spaces that would enter and exit from N. Moore Street. The remaining 419 spaces would be accessed from Ft. Myer Drive. The CACI building currently has 164 parking spaces in the garage. *(continued)*

(continued)

Using the trip generations from development east of N. Moore Street [Figure 1X and Table 1X] with existing faregate data, we estimate that 1,541 station entries and 454 exits will occur during the PM peak hour in build-out year 2015 [Table 4X]. Without the new elevator entrance, the two JBG developments would generate a 34% increase in station entries from pedestrian trips across N. Moore Street at the mid-block crosswalk and the crosswalks at 19th Street. Table 4X shows that the combined transit trips from the two JBG developments would generate 517 peak PM hour entries and 142 exits: 285 station entries/83 exits from the RCP development; and 232 station entries/59 exits from the Waterview development.

Due to the high volume of bus traffic on N. Moore Street and the need to maintain a good level of service for bus operations, it is important to analyze pedestrian trips crossing N. Moore Street since many pedestrians access the station via the non-signalized, mid-block crossing and the RCP development will add additional automobile traffic on the already busy street. In addition, the RCP project will eliminate the pedestrian skybridge which connects the existing station mezzanine with the building on the east side of N. Lynn Street.

The following assessment of vehicular and pedestrian traffic is for the PM peak hour and assumes full development build-out without the proposed station elevator entrance.

Pedestrian Traffic Assessment

This assessment utilized methodologies in the 2000 HCM (Highway Capacity Manual) to analyze the operating conditions of the crosswalks at the intersections of N. Moore/N. 19th Street and N. Moore/Wilson Blvd. The analysis assumed 15 foot wide crosswalks and existing signal timing plans.

The south crosswalk at the intersection of N. Moore and N. 19 Street would operate at LOS E during PM peak hour. The corners of N. Moore Street and N. 19 Street would operate at LOS B. The results indicated that mitigation measures would be required to improve the crossing.

The north crosswalk at the intersection of N. Moore Street and Wilson Blvd. would operate at LOS C during PM peak hour. The corners of N. Moore Street and Wilson Blvd. would operate at LOS D.

The analysis of the mid-block crossing at the front of Metro Station utilized the concept of “critical gap” established in the HCM. Crossing the street requires pedestrian judgment in selecting an acceptable gap. With two-way traffic and buses impeding sight-lines, the vehicle traffic, particularly bus traffic, would be blocked by pedestrian movements since buses are required to stop at the mid-block crossing even when pedestrian are not present. When a pedestrian steps from the curb, a bus cannot proceed until the pedestrian clears the crosswalk. The percent of traffic blocked at the mid-.

(continued)

(continued)

block crosswalk would be about 80%, the LOS for vehicles would be F (230 seconds approach delay), and traffic flow (including buses) would experience significant delays. A traffic study would be needed to evaluate mitigation measures

Vehicular Traffic Assessment

The intersection of N. 19th street and N. Moore Street would operate at an acceptable LOS C, however, the northbound approach will experience delays, up to 7.1 seconds, and the LOS would be E. The intersection of N. Moore Street and Wilson Blvd. would operate at LOS C without significant delays.

Traffic Assessment with New Station Entrance

The traffic conditions would be significantly worse without the three new elevators to divert pedestrian crossings on N. Moore Street. Assuming 75% of the pedestrian from the east of N. Moore Street would use the new elevators, the mid-block traffic operation would be improved to LOS C (from LOS F), and the delay for vehicles would be reduced to 21 seconds (from 230 seconds). The safety of pedestrian would be greatly improved with less crossings and good bus service on N. Moore Street could be maintained.

WMATA Recommendations

Given the impacts from the new development projects around Rosslyn station and increased Metrorail ridership, it is critical that the proposed new elevator entrance be implemented concurrent with the RCP development to ensure and acceptable level of service for bus operations. At a minimum, the RCP project development should provide civil and structural construction and/or accommodation so as not to preclude construction of a station elevator entrance in the future. The design and construction of any new WMATA station facility shall: conform to the design principles described and shown in this Report, must meet the requirements of the latest WMATA Standards and Criteria; and be subject to WMATA review and approval.

WMATA staff recommends that any new station entrance design be subject to further analysis for impacts to the existing station in regards to local jurisdictional codes and NFPA 130 requirements for emergency exiting capacity. Any conclusions developed from this study shall be in agreement with Arlington County Fire Code Officials.

6.0 NEXT STEPS

In December 2006, the Arlington County Board voted to defer approval of the Rosslyn Central Place project. There were several unresolved issues, including finalizing the community benefits package, which was expected to include a contribution toward the construction of the new elevator entrance. The project is to be re-considered by the County Board in April 2007.

(continued)

(continued)

The Rosslyn Central Place project will be subject to further review and coordination from WMATA and Arlington County for the elevator entrance project, the bus alleyway, and the transportation facilities on N. Moore Street. In earlier meeting with the developer's consultants for the 1812 N. Moore Street project, the Office of Adjacent Construction and Joint Development (ADJC) advised Arlington County and the developer to coordinate the sequence of construction and maintenance of traffic along N. Moore Street with WMATA and JBG Companies project. Both the RCP and 1812 N. Moore Street projects were recently submitted to WMATA for the formal Adjacent Construction review process.

WMATA is currently participating in Arlington County's Site Plan Review Committee (SPRC) meetings for the 1812 N. Moore Street project.

APPENDIX 1.0 METHODOLOGY FOR FORECASTING ENTRY/EXITS

Area Development Pattern

For the purpose of estimating entries and exits, this analysis assumes that all potential Metrorail customers accessing the new elevators will arrive from areas east of N. Moore Street. By using the new elevators, customers can reduce their walking time and avoid crossing traffic on N. Moore to reach the existing escalators. For example, a customer walking to the station from the northeast could reduce their travel time by approximately 2 ½ minutes by accessing the station platform via the new elevators in lieu of riding down the existing escalators.

The analysis also assumes that Metrorail customers accessing the station from the west of N. Moore Street will continue to use the existing escalators.

(continued)

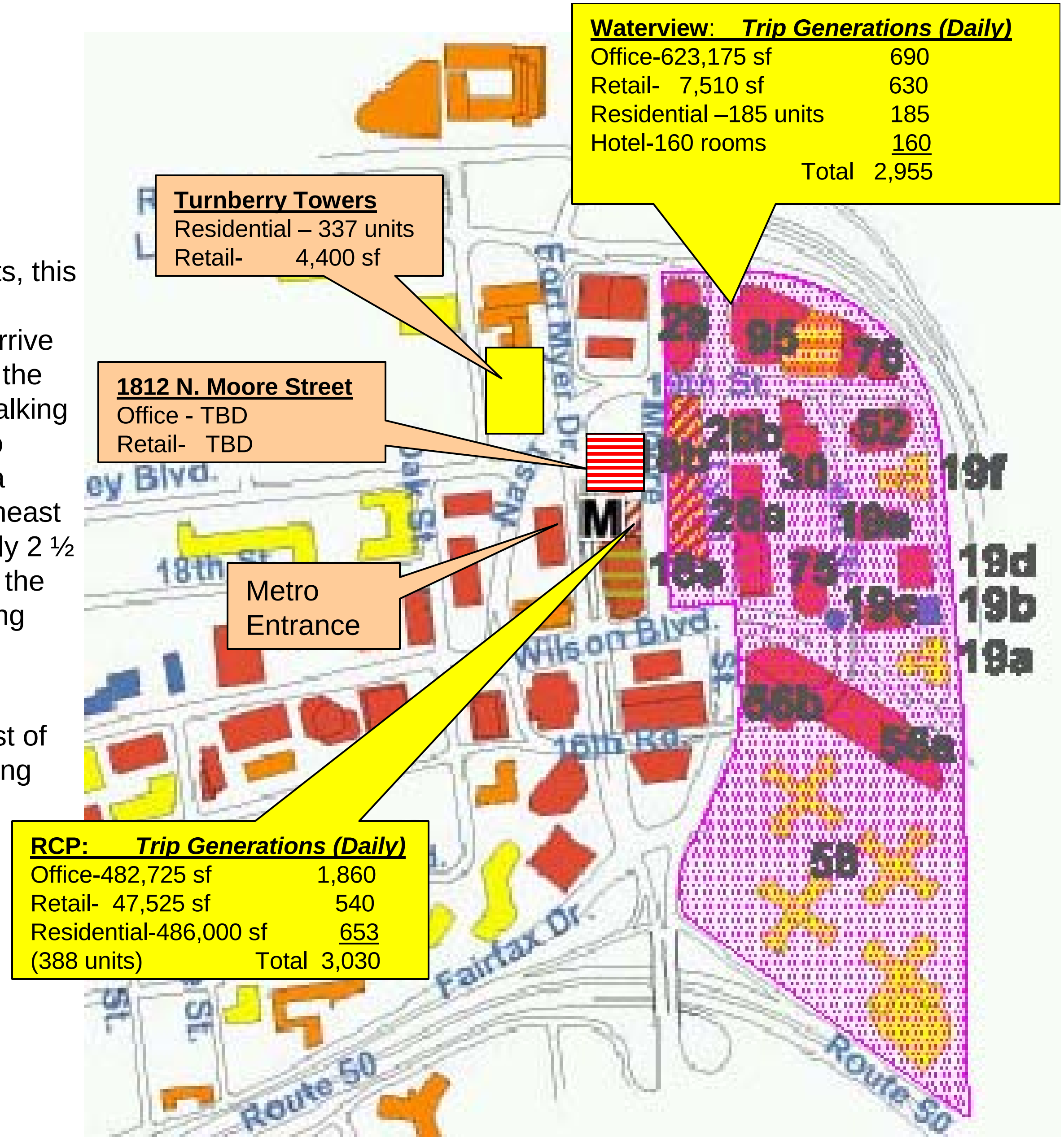


Figure 1X: Area of Trip Generations to New Entrance

(continued)

Like the development surrounding the Rosslyn station area, the area east of N. Moore Street shown in Figure 1X includes a mix of land uses such as office (3.76 million square feet), retail (375,000 square feet), hotel (160 units) and residential (over 2,000 residential units). Additionally, the study area includes a 9,000 square feet theater which is not considered in the analysis because it does not impact ridership during the peak period.

Figure 1x also shows two major projects in the development pipeline on the west side of N. Moore Street; 1812 N. Moore Street and Turnberry Towers, which are not included in this analysis.

New Elevator Entrance Demand

The demand for the new elevators during the peak periods is derived by applying the Metrorail mode split factor from WMATA's 2005 Development Related Ridership Survey (DRRS) to trip generation estimates from the ITE Trip Generation Manual - 7th Edition. The DRRS provides the latest estimates of Metrorail mode split by distance to the station.

Because higher demand for Metrorail access and egress typically occurs during the peak periods, this analysis further breaks out estimates for the AM and PM peak, 4 hour periods [Table 3X]. For development within 500 feet of the new street elevators, the analysis assumes that the office development would generate 35% Metrorial customers during the AM and PM peak periods, 54% from the residential units, 27% from the hotels, and 29% from retail. The transit share decreases incrementally the further the walking distance is from building entrance to the station entrance.

Variations in access and egress patterns between the morning and afternoon peak periods are also captured in the analysis. For office-generated trips, 15% of the morning peak trips are assumed to use elevators to enter Metro and 85% use elevators to exit Metro. Likewise, 73% of the residential morning peak trips would access Metro via elevators and 17% exit Metro via elevators. The ratios for office and residential trips are reversed in the afternoon peak period. For both hotels and retail, the split between entries and exits is even for both peak periods.

Table 1X: Transit Trip Generations from Development East of N. Moore Street

		Land Use				Metrorail mode choice by distancem (2005 survey)				Trip Generation Daily Metro Entry/Exits (ITE Rates)				Trip Generation Per Peak Period Metorail Trips				Trip Generation AM Peak Period (4hr) Metro Entries				Trip Generation PM Peak Period (4hr) Metro Entries			
	Distance in ft	Office	Retail	Residential	Hotel	Office	Retail	Residential	Hotel	Office ,000 sqft	Retail, 000ft	Residential	Hotel	Office	Retail	Residential	Hotel	Office ,000 sqft	Retail, 000ft	Residential	Hotel	Office ,000 sqft	Retail, 000ft	Residential	Hotel
Trip Orgin										11.01	49.21	4.2	8.17	33%	10%	20%	20%	0.15	0.5	0.73	0.5	0.85	0.5	0.27	0.5
18a-RCP Office	100	482,726	11,539			0.35	0.29	0.54	0.27	1,860	165	0	0	619	16	0	0	93	8	0	0	527	8	0	0
18b-RCP Res	230	0	35,988	288		0.35	0.23	0.54	0.27	0	407	653	0	0	41	131	0	0	20	95	0	0	20	35	0
26a	100	249,536	18,412			0.35	0.23	0.54	0.27	962	208	0	0	320	21	0	0	48	10	0	0	272	10	0	0
26b	500	347,295	6,565	0		0.33	0.23	0.52	0.27	1,262	74	0	0	420	7	0	0	63	4	0	0	357	4	0	0
29	500	128,000	6,565			0.31	0.23	0.5	0.27	437	74	0	0	145	7	0	0	22	4	0	0	124	4	0	0
30	500	201,400	55,600			0.31	0.23	0.5	0.27	687	629	0	0	229	63	0	0	34	31	0	0	195	31	0	0
75	500	243,700	15,766			0.31	0.23	0.5	0.27	832	178	0	0	277	18	0	0	42	9	0	0	235	9	0	0
95-Waterview	500	623,176	7,510	185	160	0.31	0.23	0.5	0.27	2,127	85	389	353	708	9	78	71	106	4	57	35	602	4	21	35
52	750	295,948				0.28	0.23	0.48	0.27	912	0	0	0	304	0	0	0	46	0	0	0	258	0	0	0
76	750	252,193				0.28	0.23	0.48	0.27	777	0	0	0	259	0	0	0	39	0	0	0	220	0	0	0
19a	1100			99		0.28	0.23	0.48	0.27	0	0	200	0	0	0	40	0	0	0	29	0	0	0	11	0
19c	950	142,500	10,800			0.28	0.23	0.48	0.27	439	122	0	0	146	12	0	0	22	6	0	0	124	6	0	0
56b	750	457,900	43,000			0.28	0.23	0.48	0.27	1,412	487	0	0	470	49	0	0	71	24	0	0	400	24	0	0
19b	1000					0.26	0.23	0.45	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19d	1100	147,500	3,000			0.26	0.23	0.45	0.27	422	34	0	0	141	3	0	0	21	2	0	0	120	2	0	0
19e	1000	148,732				0.26	0.23	0.45	0.27	426	0	0	0	142	0	0	0	21	0	0	0	121	0	0	0
19f	1000			94		0.26	0.23	0.45	0.27	0	0	178	0	0	0	36	0	0	0	26	0	0	0	10	0
56a	1100	446,500	36,400			0.26	0.23	0.45	0.27	1,278	412	0	0	426	41	0	0	64	21	0	0	362	21	0	0
58	1500		139,000	1,633		0.21	0.23	0.41	0.27	0	1,573	2,812	0	0	157	562	0	0	79	411	0	0	79	152	0
Trips by Use Type by Building										13,833	4,450	4,231	353	4,607	445	846	71	691	222	618	35	3,916	222	228	35
All trips by building										22,867								1,566				4,402			
Arrival rate at entrance (people per minute)																		7				18			

Table 2X: Projected PM Peak Entry/Exits at New Entrance in 2015

	Time	Entries	Exits
PM Peak Period Entry/Exits *	3:00 - 3:30	533	356
(4 Hr Period)	3:30 - 4:00	794	384
	4:00 - 4:30	1001	490
	4:30 - 5:00	1216	556
	5:00 - 5:30	1357	773
	5:30 - 6:00	1134	820
	6:00 - 6:30	830	762
	6:30 - 7:00	512	501
2006 Peak PM Period Entries/Exits (Existing)	**Totals**	**7377**	**4642**
1/2 Hr. Peak Entries/Exits (%) (Existing)		0.18	0.17
2015 Projected Entry/Exits (New Entrance)		4,402	1,566
2015 PM Peak 1/2 Hr Entry/Exits (New Entrance)		**810**	**261**

Table 3X: Projected AM Peak Entry/Exits at New Entrance in 2015

	Time	Entries	Exits
PM Peak Period Entry/Exits *	3:00 - 3:30	533	356
(4 Hr Period)	3:30 - 4:00	794	384
	4:00 - 4:30	1001	490
	4:30 - 5:00	1216	556
	5:00 - 5:30	1357	773
	5:30 - 6:00	1134	820
	6:00 - 6:30	830	762
	6:30 - 7:00	512	501
2006 Peak PM Period Entries/Exits (Existing)	**Totals**	**7377**	**4642**
1/2 Hr. Peak Entries/Exits (%) (Existing)		0.18	0.17
2015 Projected Entry/Exits (New Entrance)		4,402	1,566
2015 PM Peak 1/2 Hr Entry/Exits (New Entrance)		**810**	**261**

Table 4X: JBG Development Peak Hour Enty/Eixts in 2015

	Time	Entries	Exits
PM Peak Period Entry/Exits *	3:00 - 3:30	533	356
(4 Hr Period)	3:30 - 4:00	794	384
	4:00 - 4:30	1001	490
	4:30 - 5:00	1216	556
	5:00 - 5:30	1357	773
	5:30 - 6:00	1134	820
	6:00 - 6:30	830	762
	6:30 - 7:00	512	501
2006 Peak PM Period Entries/Exits	**Totals**	**7377**	**4642**
1 Hr. Peak Entries/Exits (%)		0.35	0.29
2020 PM Peak Period Entry/Exits (from East)		4,402	1566
PM Peak 1 Hr Entry/Exits from East		**1,541**	**454**
JBG Development PM Peak Period Entry/Exits		1,477	488
PM Peak 1 Hr Entry/Exits from JBG Waterview & RCP Developments		**517**	**142**
% JBG Entry/Exists from East of Station		0.34	0.31

APPENDIX 2.0 ELEVATOR QUEUING CAPACITY

Alternative 1

As discussed in the Demand Analysis and Elevator Capacity Section, WMATA uses peak half-hour demand projections when planning new station mezzanines and elevators to ensure they can comfortably, safely, and efficiently accommodate Metrorail customers during periods of peak capacity. Figure 2X shows a diagram of passengers queuing in front of the elevators on the concourse level. For our purposes, the diagram shows 28 customers waiting for an elevator in lieu of the projected 57 passengers shown in Table 2 since, in most instances, only one train would normally arrive in the station instead of two trains simultaneously as was analyzed.

If the mezzanine was designed to accommodate the maximum queue capacity for 57 passengers waiting for an elevator, then additional elevators would be necessary to handle the load. More than 3 elevators would not easily fit into the Rosslyn Central Place development and could place an unfair burden on the development. On those rare occasions when crowded conditions may occur, customers could use the existing escalators to avoid a long wait time for an elevator.

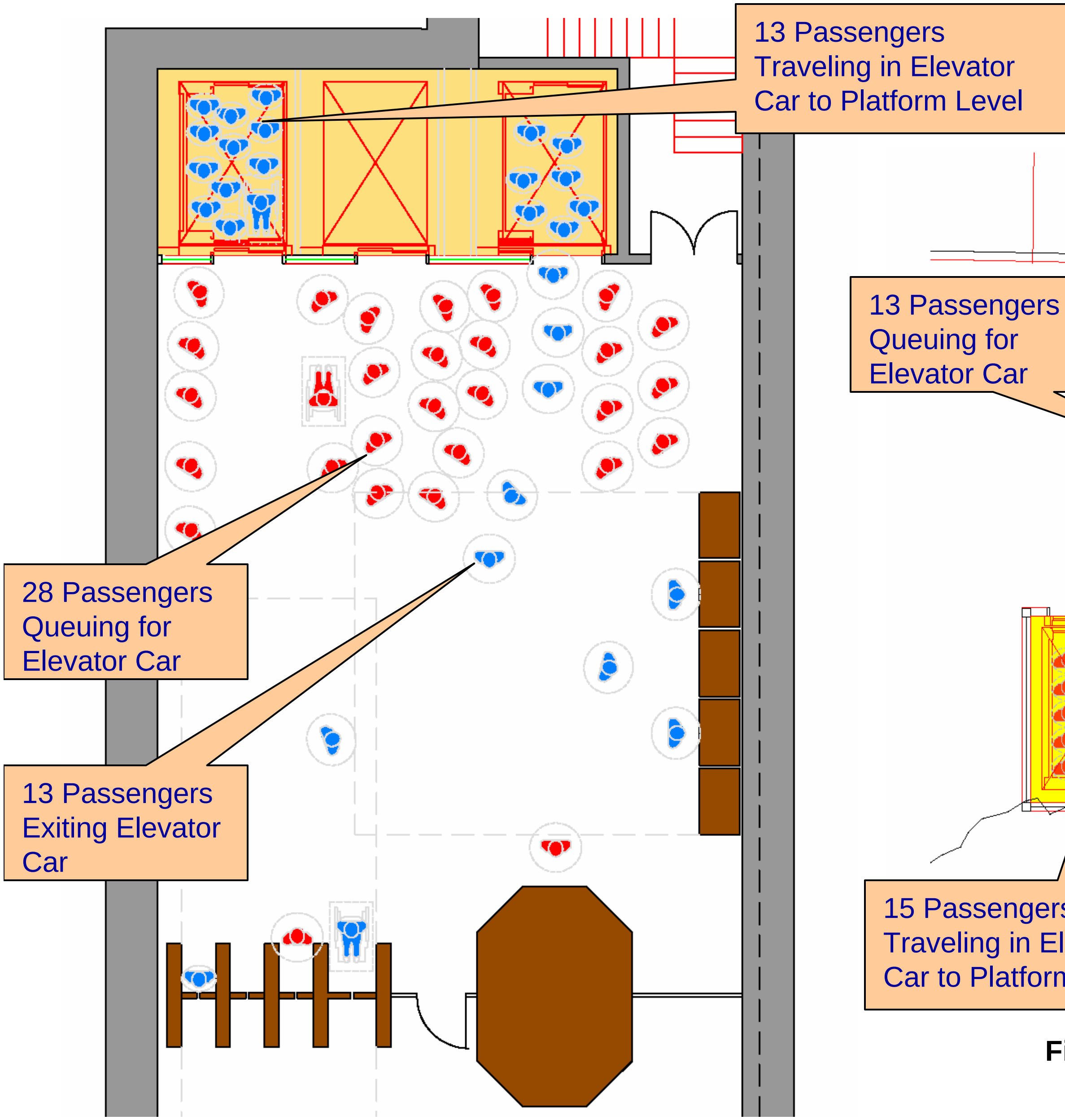
At the street level, Figure 3X shows that 13 customers queuing in front of the elevators can be accommodated on the sidewalk in the PM peak half-hour period without crowding.

Alternative 2

Figure 4X shows a diagram of passengers queuing in front of the elevators in the concourse at the platform level. The diagram shows 28 customers waiting for an elevator and 15 passengers exiting one elevator. A second elevator car with another 15 passengers is shown in transit from the street level while some of the 28 customers begin to queue. An early audible and visible signal from the hall lantern could give customers ample time to queue in front of an approaching elevator which would help avoid conflicts with passengers exiting the elevator car and speed the process.

At the street level, Figure 5X shows that 15 customers queuing in front of the elevators can be accommodated in the Paid Area of the Mezzanine in the PM peak half-hour period without overcrowding.

Figure 2X: Alternative 1: Concourse Level – Queuing in AM Peak ½ Hour



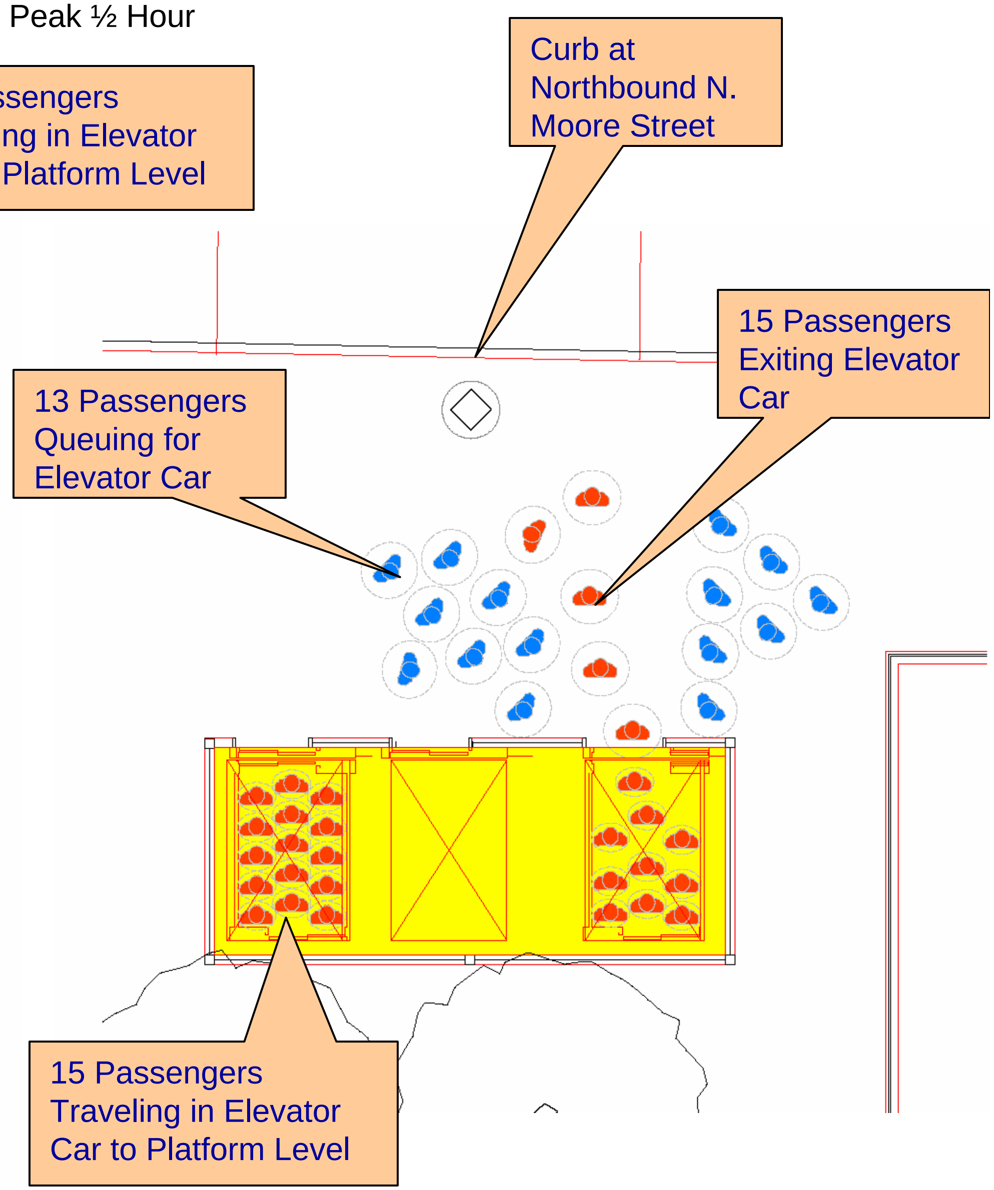


Figure 3X: Alternative 1: Street Level – Queuing in PM Peak ½ Hour

Figure 4X: Alternative 2: Concourse Level
– Queuing in AM Peak ½ Hour

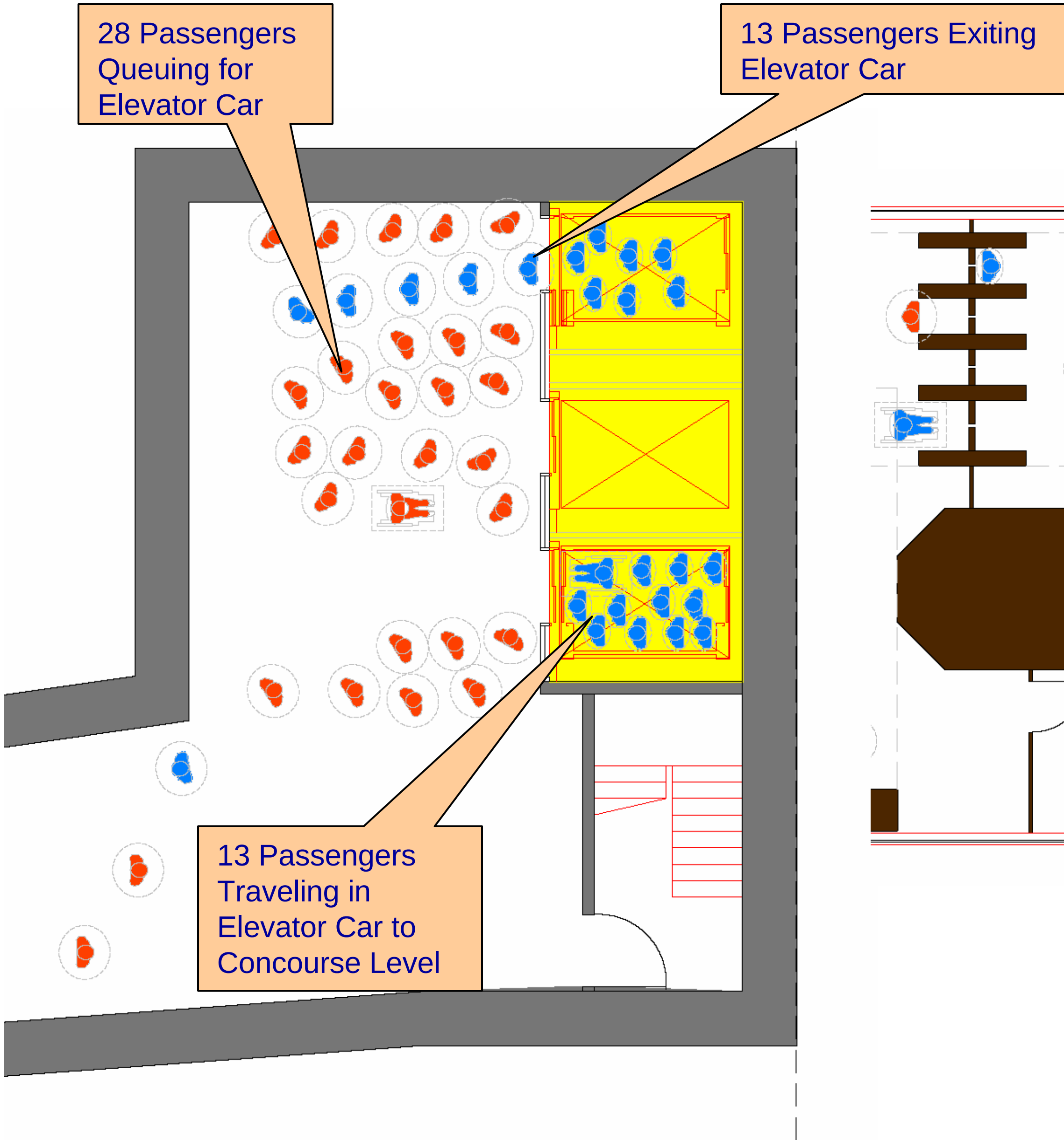
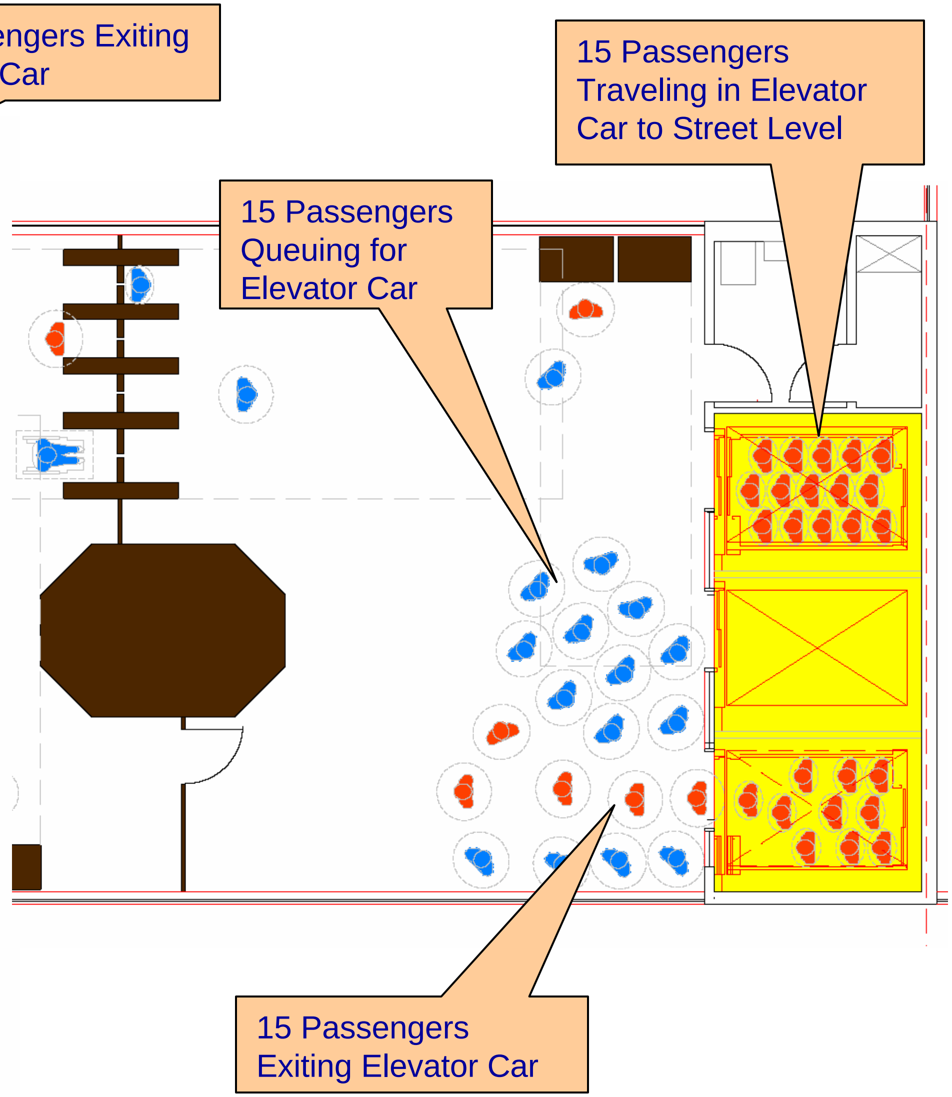


Figure 5X: Alternative 2: Street Level
– Queuing in PM Peak ½ Hour



Customer Queue Area

The Vertical Transportation Handbook was referenced to provide standard queuing areas for each of the body figures shown in Figures 10, 11, 17, and 18. The dashed line shown around the body of the customers queuing in front of the elevators is considered a nominal 7 square foot area for queuing.

The minimum queue area for a customer in a wheelchair, which is included in the analysis, is 10 square feet (30 x 48 inches). The dashed line shown around the body of the customers in the elevator car is a 3 square feet area and is considered a crowded condition for elevator queuing but is acceptable for riding inside of an elevator car.

Methodology for Calculating Queuing

The methodology for calculating the number of passengers queuing at the elevators in the concourse on the platform level assumed the worst-case scenario of two trains arriving together at the station and unloading simultaneously [Figure 7X]. Further assumption included: (1) three elevators with an average cycle time of 30 seconds; (2) more passengers would alight from cars closer to the exit; (3) one-third of each car's alightings occurred at each set of doors; (4) future alightings will take place on the upper and lower platforms in the same proportions as today; (5) peak 2 hour alightings would be uniformly distributed throughout the time period; and (6) the elevators would carry an average of 15 passengers per car.

At the street level, the queuing analysis used a 30 second average elevator cycle time for three operating elevator cars. It also assumed that all patrons arriving in the peak 30 minute period were evenly distributed.

Figure 6X: Travel Distances from Train Car Doors

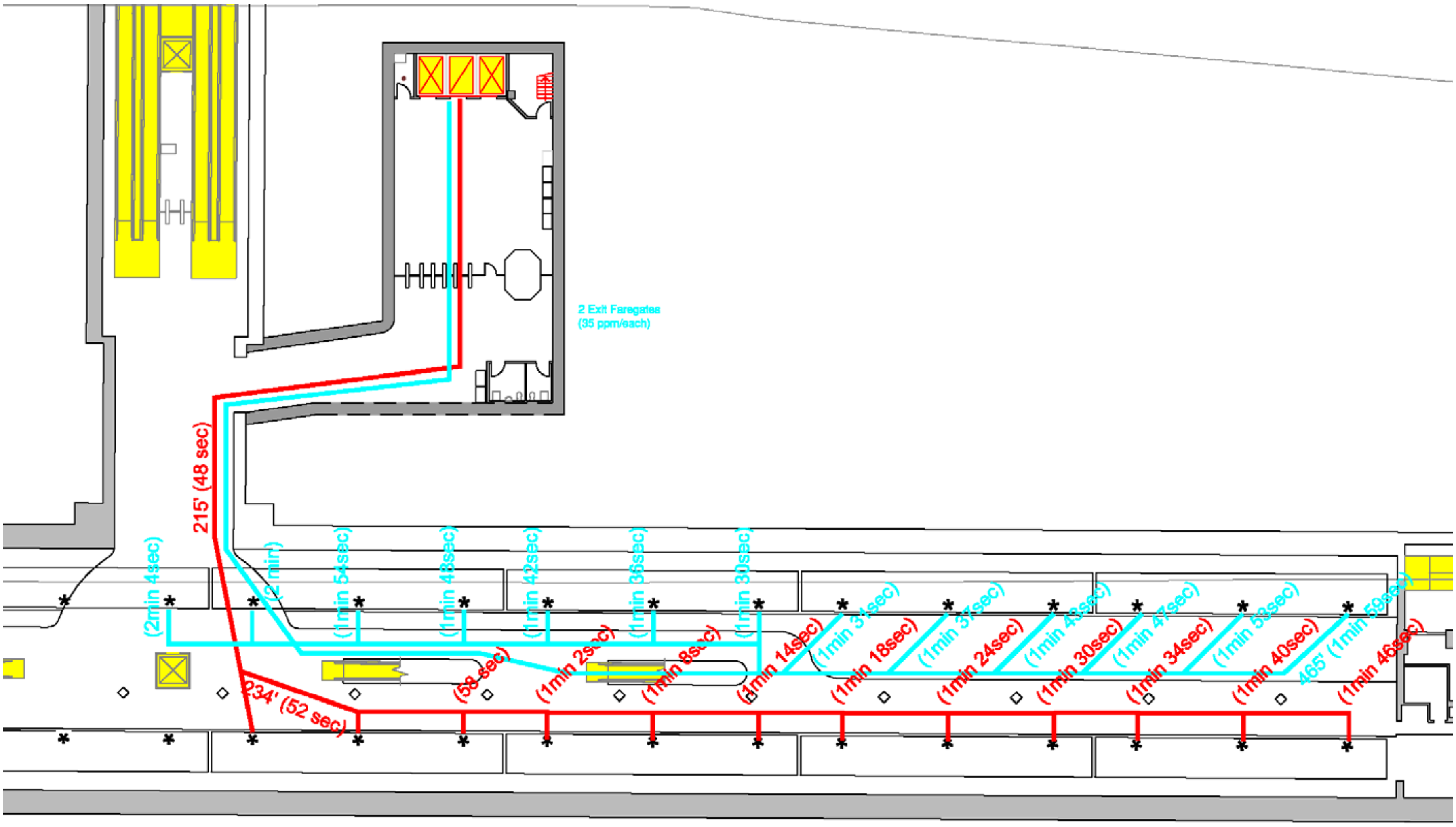


Table 5X: Train Car Exiting Distribution

3 Elevators																				
		Train Loading Car																		
		1			2			3			4			5			6			
Inbound	0.483	91			118			91			102			98			77			
		77			92			82			77			79			39			
		87			92			69			78			88			66			
		85			97			85			90			107			71			
Average		85			99.75			81.75			86.75			93			63.25			509.5
		16.7%			19.6%			16.0%			17.0%			18.3%			12.4%			
		10.0%			15.0%			25.0%			25.0%			15.0%			10.0%			100.0%
		3.3%	3.3%	3.3%	5.0%	5.0%	5.0%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	5.0%	5.0%	5.0%	3.3%	3.3%	3.3%	100.0%
Cycle		2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	
	28	0.93	0.93	0.93	1.39	1.39	1.39	2.32	2.32	2.32	2.32	2.32	2.32	1.39	1.39	1.39	0.93	0.93	0.93	28
Outbound	0.517																			
		15.0%			20.0%			15.0%			15.0%			20.0%			15.0%			100.0%
		5.0%	5.0%	5.0%	6.7%	6.7%	6.7%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	6.7%	6.7%	6.7%	5.0%	5.0%	5.0%	100.0%
Cycle		2	2	2	2	2	2	2	3	3	3	3	2	2	2	2	2	2	2	
	30	1.49	1.49	1.49	1.99	1.99	1.99	1.49	1.49	1.49	1.49	1.49	1.49	1.99	1.99	1.99	1.49	1.49	1.49	30
Cycle 1		0	0	0.929	1.393	1.393	1.393	2.322	2.322	2.322	2.322	2.322	2.322	1.393	1.393	1.393	0.929	0	0	24.1
Cycle 2		2.42	2.42	1.491	1.988	1.988	1.988	1.491	0	0	0	0	1.491	1.988	1.988	1.988	1.491	2.42	2.42	27.6
Cycle 3		0	0	0	0	0	0	0	1.491	1.491	1.491	1.491	0	0	0	0	0	0	0	6.0
																				57.7

Table 6X: Faregate and Fare Vendor Capacity Analysis

Assumptions

1. 3-minute headways during peak hours
2. Fare Gate service rate: 35 passengers/minute
3. Volume to capacity ratio: 0.70 (Level of Service of D, NY MTA CEQR manual)
4. Traffic Volume for 2020: 719 (entry)/156 (exit), 30-minute peak volume

Number of fare gates required (2020)

Number of fare gates for passengers entering the station

Adjusted volume: 719/0.8 (peak hour factor) = 899.
Capacity required: 899/30 minutes/X (capacity of fare gates required) = 0.7. X = 42 persons/minute.
Number of fare gates required: 42/35 = 2 fare gates.

Number of fare gates for passengers exiting the station

Adjusted volume: 156/0.8 (peak hour factor) = 195.
Capacity required: 195/10 (number of trains during the peak 30 minutes)/X (capacity of fare gates required) = 0.7 X = 28 persons/minute.
Number of fare gates required: 28/35 = 1 fare gates.

Total number of fare gates required: 2 (for entering) + 1 (for exiting) + 1 (ADA) = 4.

Number of fare vending machine required (2020)

Analysis Assumptions

1. Express Vendor Service Rate: 90 transactions per hour.
2. Peak Hour Factor: 0.95.
3. 20% of the total entries and exits during the peak hour using fare vending machine.
4. 0.7 Volume to Capacity ratio is used for threshold.

0.2*(719 + 156)/0.95 = 184 customers would use fare vending machines during the peak 30-minute period.
184/X/45 = 0.7 **X = 6** : **Total number of fare vending machine required (Not including fare adding machines)**